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Cover Picture

See the article below, and the article 'Indications of Instability' on pages 1644 to 1648.

Roberval the Movie

By J KNIGHTS

The roberval weighing machine is superficially a simple mechanism. In its most fundamental form it consists of four metal bars loosely pinned into a parallelogram, pivoted on a central support with weight–carrying plates rigidly attached to the tops of the two vertical rods.

It is difficult to see, upon first examination, how the operation of such an uncomplicated device could give rise to a set of fifteen equations in a learned treatise on 'Mechanical Philosophy.'

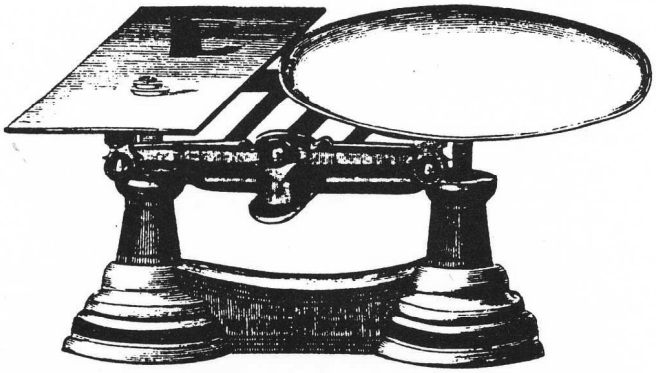

Fig. 1a. W & T Avery. 1850. Supplied with pewter or copper dish. Capacity 4lb to 112lb.

Such was the case, however, in a work by one Pratt, which was a standard tome of learning in the mid 19th century. Clearly in those days, despite the use of the principle in the manufacture of commonplace weighing machines, the mechanism was still invested with some degree of wonder and suspicion redolent of its origin as the 'Enigme Statique' described, but never, apparently, explained by the eponymous mathematician Personne de Roberval some three hundred years earlier. See Fig. 2.

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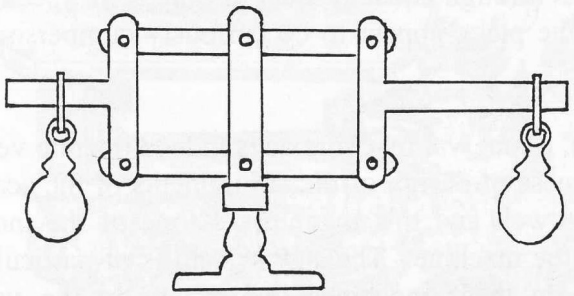


Fig. 2. The roberval parallelogram, demonstrating the so-called *Static Enigma* in which the pivoted frame retains its state of equilibrium despite the fact that the equal masses are at unequal distances from the central fulcrum.

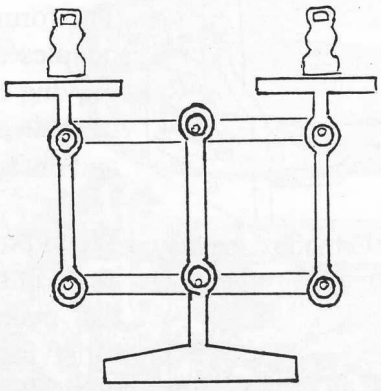


Fig. 3. A more practical version of the frame in which weights are carried on plates attached to the tops of the legs. When the weights are placed centrally, all forces act vertically through the pivots and no tension or compression occurs in the horizontal components.

When one sees that original device, (Fig. 2,) with its projecting arms, instead of pans or plates, it is slightly more understandable how it could have appeared that the mechanism defied the law of the lever and permitted weights of equal mass to balance when, apparently, at different distances from the pivot.

Having been told that it is an enigmatic device, of course, one does begin to believe it and seek to understand the mystery.

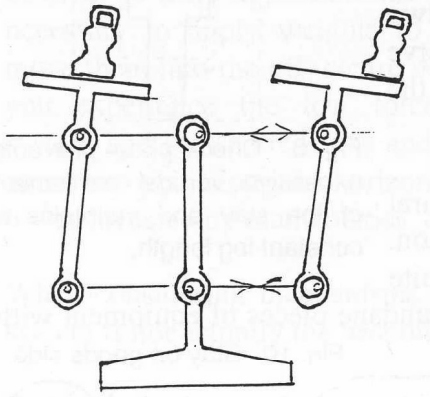


Fig. 4. With the weight placed off-centre, the right hand leg becomes subject to the turning force of the weight acting at a distance from a pivot.
With the weight on the outside of the pan, the leg turns about the upper pivot and applies a compressive force to the lower horizontal component.
It also turns about the lower pivot and applies a tensile force to the upper component.
These two forces are of equal magnitude and, provided that the horizontal components are parallel, act at the two leg pivots in opposite directions.
When the frame is horizontal and parallel, therefore, there is no vertically acting component in the 'induced' forces to act at the load pivots and affect equilibrium.

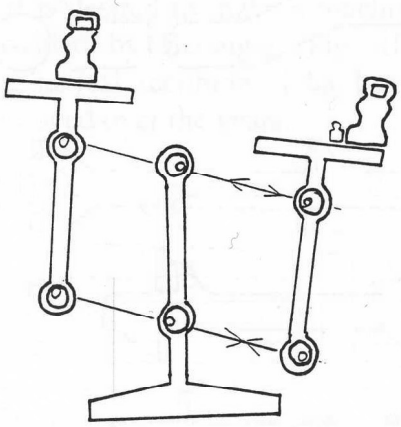


Fig. 5. When the frame becomes displaced from the horizontal, the forces induced by off-centre loading do have vertical components.
Provided that the top and bottom members remain parallel in the displaced condition however, these forces will act in an equal and opposite way at the leg pivots and have a net vertical effect of zero.

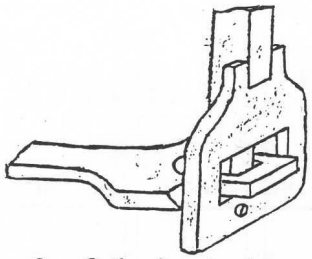


Fig. 6. Orthodox leg/stay, with knife-edges on stay.

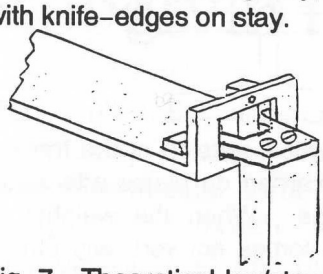


Fig. 7. Theoretical leg/stay connection with knife edges on the leg, as used in Notice number 730.

The formal explanations of the scale's secrets, whether in terms of couples and induced equal and opposite forces, or work done in moving equal weights through equal vertical distances irrespective of their position on the plate, appear to be curiously cumbersome and unsatisfactory.

When properly made, a roberval machine does indeed operate very well. It is the cleverness of design of the components of the scale that make it work so well and this ingenuity is one of the most satisfying aspects of the machine. The stay system is of particular note, (Fig. 6,) even in these machines (which are in the vast majority,) which have abandoned the theoretical purity of the balance of Westphal, and have the knife edges on the stay instead of the leg, as best design would dictate should be done. (Fig. 7.)

In the heretical version, (Fig. 6,), universally adopted for reasons of economy, the stay admirably performs its principal function of absorbing the lateral pressures without causing excessive friction to disturb the weighing ability of the beam, and manages to maintain its place in the parallelogram simply through the operation of gravity and the judicious fitting of check plates to prevent undue displacement, (Fig. 8.)

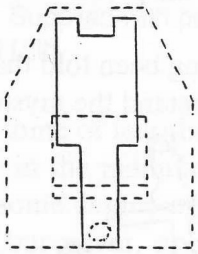


Fig. 8. Check plate: prevents excessive vertical movement of the stay and maintains a constant leg length.

In the older accelerating machines, not to mention the still-to-be-found deadweight, the stay system is superficially different to that in the vibrating machine. Here the flat stay is replaced by two 'hook and eye' devices, (Fig. 9 and 10,) which, however, still serve to maintain equal length in tension and compression and allow the system to weigh accurately even when loaded eccentrically.

Certain types of equipment have, over the years, been natural candidates for a degree of ornamentation in their construction. When scales were made in cast and wrought iron, it was quite normal to go to quite bizarre lengths in bestowing otherwise mundane pieces of equipment with

Fig. 9. Stay on weights side.

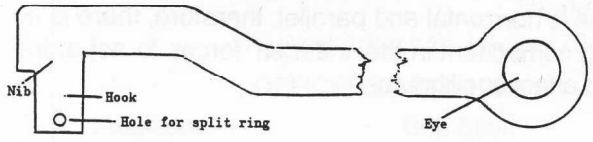


Fig. 10. Stay on goods side.

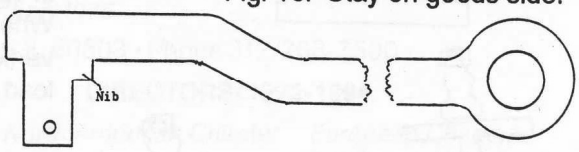


Fig. 11. Single compound stay used in conventional roberval machines.

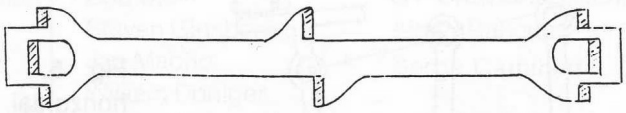


Fig. 12. Knife edges in contact when stay in compression.

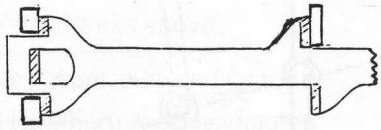
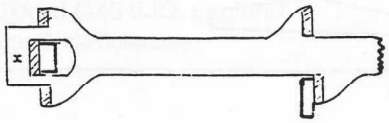


Fig. 13. Knife edges in contact when stay in tension.



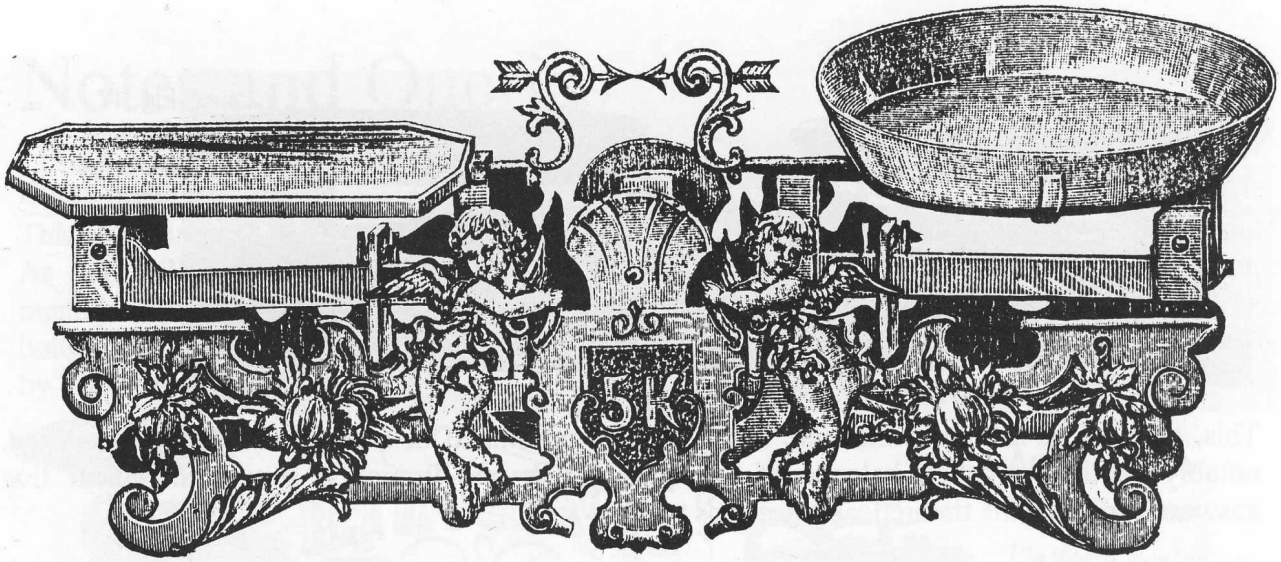


Fig. 14. Steinfeldt & Blasberg, circa 1892. Their ornamental model of Beranger. Capacity 5kg to 30kg.

an element of aestheticism.

A lot of the Continental Beranger (Fig. 14) and Phanzeder types of machine are still seen to be made in this ornate style with elegant curves, fretted ironwork and indicators in the shape of birds and animals, etc.

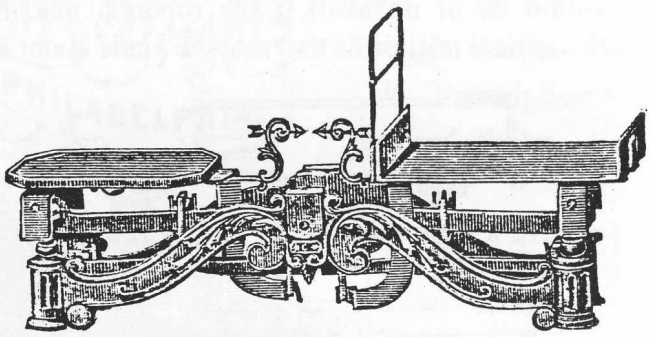


Fig. 15. Another, plainer beranger by Steinfeldt & Blasberg, circa 1892. Capacity 3kg to 30kg.

In order to truly appreciate the principle, it is necessary to apply weights to the pans and move them into the off–centre positions. Then you experience the lost forces within the system and see the tensions and compressions come into play along the horizontals. Thus does it all become clear and the mystique with which it was invested by mathematics, disappears.

When considering mechanisms for weighing machines, it must be conceded that the roberval system is not actually the best one for the job.

If it is desired to make a machine with the load pans above the weighing system, the solution provided by Beranger (Fig. 16) and others certainly provides, in terms of elegance and mechanical rectitude, a far better system than the variants of the roberval that have been produced over the years.

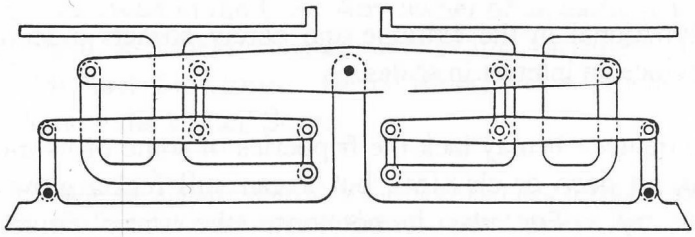


Fig. 16. Beranger's principle. His actual scales are very much flatter than this diagram would suggest. See Fig. 17.

Roberval is essentially a flawed design having to cope with its lateral forces whereas Beranger and company cleverly contrive to apply all their forces vertically and thus avoid such non–theoretical distractions. Why then was it a system so widely adopted?

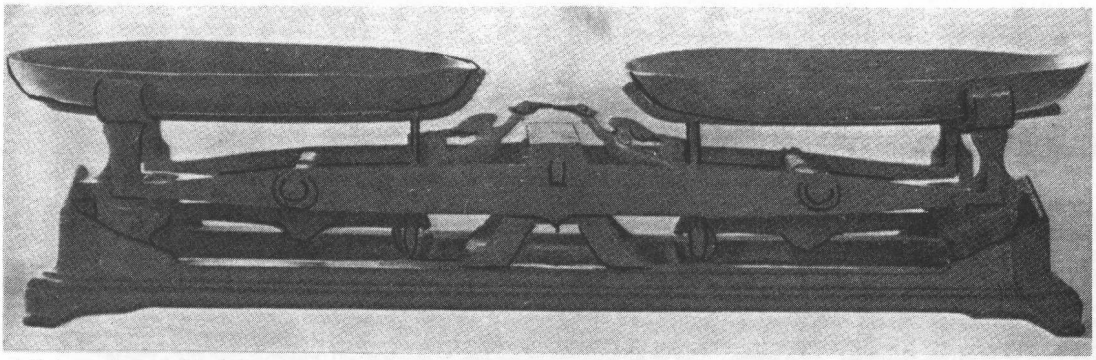


Fig. 17. Original Beranger scale.

This, after all, is a type of machine that was once prohibited in Prussia until it was modified, notably as the so-called balance of Westphal which had improved stay arrangement that answered some of the theoretical objections to the system.

There are obvious advantages of simplicity, lightness of construction and economy which would lead one to favour the parallelogram over the machine relying on subsidiary levers but these would be of no avail if the roberval machine did not actually work very well despite any theoretical criticisms that may be made about it.

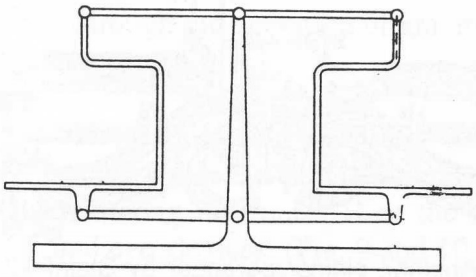


Fig. 18. Inverted roberval principle.

The type of inverted roberval scale known as the Imperial pattern, (Fig. 18 and 19,) which was once used in the front of the grocer's or butcher's shops, was also produced in a fairly ornate fashion to befit its central role in the shopkeeper's business.

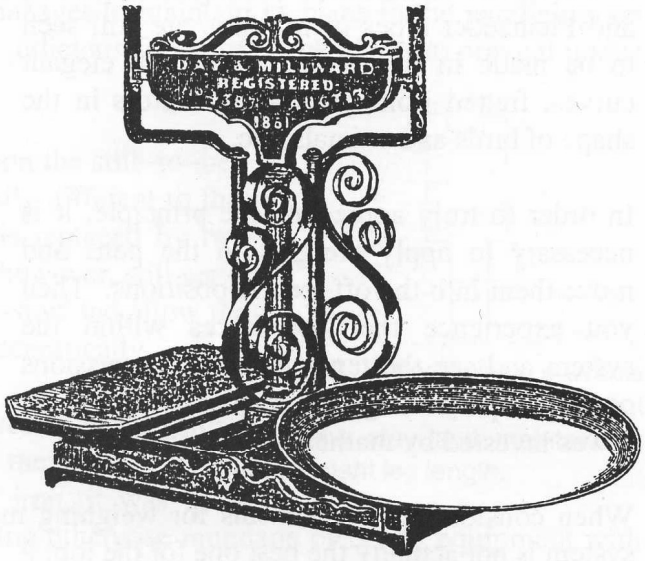


Fig. 19. Day & Millward, registered design number 4387, August 13th, 1861. Capacity 28lbs to 112lbs.

By contrast, the roberval scale that sat in the rear of the premises, where the potatoes and other down-market commodities were weighed, was usually a dull creature lacking any such outward ornamentation.

Today, the modern 'Mazak' version is functional in the extreme and barely attracts a second glance even from people who otherwise evince an interest in scales.

Do not, however, look down on this drab device. It may lack the fripperies of some of its more garish brethren, be they baroque, rococo, art deco or classical, but it can still feel a glow of superiority, when it considers its ancestry. For was it not once the static enigma?

Notes and Queries

Query number 119 — from E COHN

This H Troemner advertisement comes from Colton's General Atlas, New York, 1856 trade book. As you will see, Troemner advertised *Bevringer French Counter Scales.* EQM has never mentioned that name. What have you on Bevringer? If they are the scales shown across the bottom of the advertisement, they look beautiful. So, what can you tell me? Is there a catalogue by Troemner in about 1850?

Assay Balances,
Bank Balances,
Platform Scales,
Post Office Scales,
Gold " "
Druggist Counter Scales,
" Prescription "
Grocers' Scales,
Butchers' "
Bevringer's French Counter Scales,
AND
Weights of all sorts and sizes.

Reply — from the editor

Troemner was using a variation of the name *Béranger*, a French company whose owner had invented a parallel linked counter scale, more elaborate than the familiar roberval scales. Your question triggered a major part of this issue to explaining these practical and decorative scales. The scales each side of Troemner's name in the advert are roberval scales. The beautiful scales along the bottom are all equal-arm scales & comprise, probably, a bank scale, a druggists scales & an assay balance, (with thin pillars each side of the pillar forming primitive rests for the beam.)

The oldest Troemner catalogue that I have is their 1926 one, but I presume that earlier catalogues have survived in the U S. Any owner of an earlier catalogue might like to arrange for ISASC to reprint it, as Troemners made interesting, varied and unusual scales, which were greatly admired by Michael Crawforth. He considered that Troemners were the most exciting general scale makers in the United States.

In parenthesis, another American company that had trouble with French names was Herman Kohlbusch. In their 1902 catalogue, they advertise Robervahl scales! At least their spelling had the effect of getting the customer to say a reasonably accurate rendering of the French pronunciation!

Indication of Instability

by John Knights

Why don't British Counter machines [Fig. 1] have pointers? On many occasions over a number of years of testing such equipment this question has sprung unbidden to my brain. It usually arrives at that point in the test when you have to get the beam into perfect equilibrium, prior to applying the sensitivity allowance.

This comparatively simple task usually involves the unwitting performance of a rather bad impersonation of Richard III, [*editor: said by his enemies to have had a grotesquely deformed back,*] as the clearance under the stops is examined to ensure that the beam is indeed horizontal, and one is again forced to wonder why there is no pointer on the machine.

Fig. 1. This tiny counter roberval is shown from the rear with the scoop looking as if it was used by the left hand, whereas it was used by the right hand. The sovereign rocker shown in front of it gives an idea of its proportions. Originally black with gold.

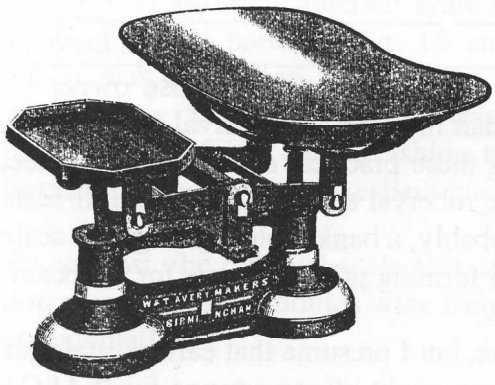
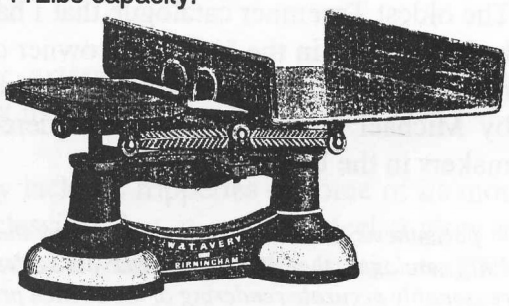


Fig. 1b. W & T Avery, 1880 catalogue. London or accelerating pattern. Classic trade scale for use in shops, on street barrows and in manufacturing.

Fig. 1c. Another W & T Avery 1880 London pattern counter scale, showing distinctly that the centre bearing has space below it, i.e., that the load was taken by the iron 'bridge' going between the side hollow 'pillars.' Available in 7lbs to 112lbs capacity.



It is not correct to accuse all British Counter machines of this lack of consideration, of course. The so called "light french" pattern with its single beam, invariably has a single pointer, (Fig. 2a,) and some even have a fixed datum against which to read it, (Fig. 2b.) The elegant Beranger [Fig. 3], in its veneered wooden box,

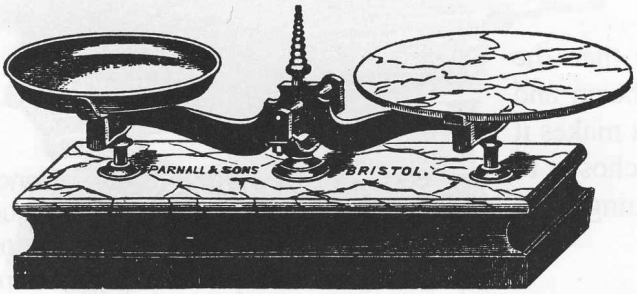


Fig. 2a, on left. Parnall & Sons Ltd, 1901. National, (French,) roberval, to weigh capacities ranging from 2lbs to 30lbs. '*We guarantee them to weigh five times as long as the imported article.*' Parnalls wrote many such 'puffs' that would be hard to substantiate in a court of law! They boasted that they had sold thousands in the last ten years, and that the National was the nation's favourite scales.

Fig. 2b, on right. Henry Pooley & Son Ltd, 1902. Light French pattern roberval pattern. Capacity 2lbs up to 10lbs. Showing the ornamental brass datum point round the pointer. Enclosed in a wooden box.

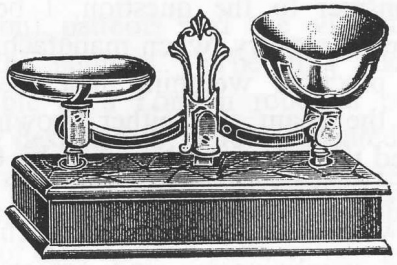


Fig. 2c, centre right. W & T Avery, 1880. Heavy French roberval pattern, with the beam divided to allow bearings to be mounted each side of the pans. Capacity 4lbs up to 20lbs . A compromise between the flimsy single beam and the robust double beam, shown in Fig 2d. Cast iron casing.

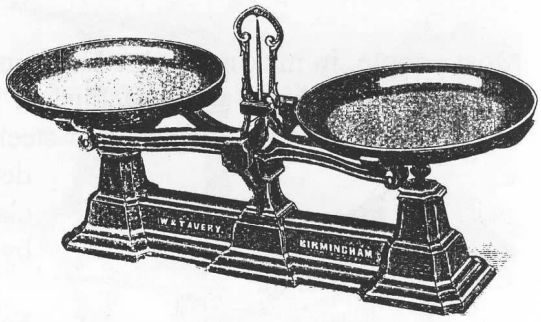


Fig. 2d, lower right. W & T Avery Ltd, 1898. Patent 3-stay counter machine. The third stay is just visible to the left of the central support. Without seeing the design of the stays below the casing, it is impossible to say whether this is a unique example of a half roberval & half beranger! Capacity 14lbs to 28lbs.

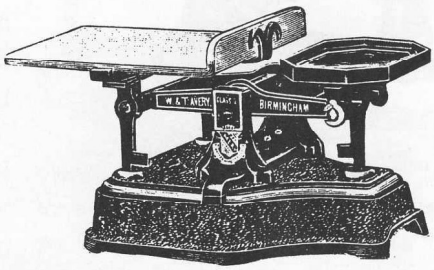
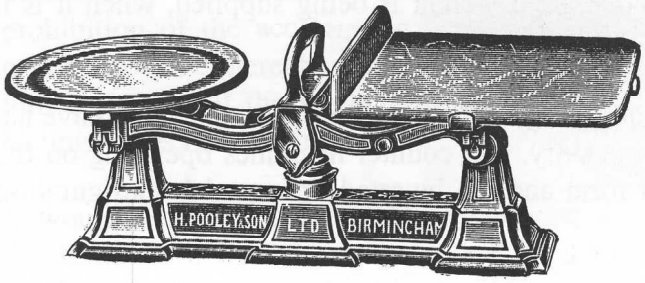


Fig. 2e, below. Henry Pooley & Son Ltd, 1902. Their 'improved' French twin beam. (They moved the bearings under the pans to the outer edge.) The double beam allowed a higher capacity, 10lbs to 40lbs. but the user and the customer still had to judge the equilibrium point without the benefit of a pointer! Many of these substantial double beam scales had a carrying handle.

All these French pattern scales had a central pillar to take the central bearings, unlike the London's 'bridge' support.



has its little golden arrows which dance behind their glass window until they finally coincide with the achievement of equilibrium.

I refer to the pattern of British counter machine with a twin beam, made originally of cast or wrought iron and more latterly of the ubiquitous mazak alloy, which, prior to metrication, was usually made in capacities of 7 lb. – 28 lb. and represented the most common

form of non-graduated machine in use in this country for many years.

It is, in many ways, a much better machine than the normal continental pattern that had a single beam and uncomfortably long knife-edges, and this fact makes it more strange that the designers should have chosen to omit so obvious an adjunct to accurate weighing from their excellent machines.

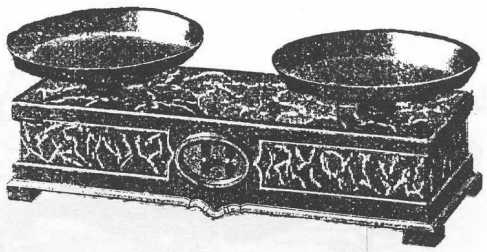


Fig. 3a. W & T Avery, 1880. French beranger pattern. The golden arrows just showing in the oval window show equilibrium when they line up in the centre. Capacity 2lbs to 120lbs.

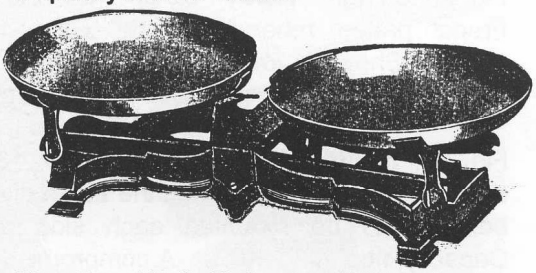


Fig. 3b. W & T Avery, 1880. Another beranger, but with a cast iron frame, instead of an enclosed box. Capacity 2lbs to 120lbs.

Both berangers vibrate.

The answer to the question, I believe, lies in the nineteenth century, when manufacturers first began to make practical weighing machines, with the pans above the beam, and either knowingly or otherwise, invoked the principle described by Gilles Personne de Roberval who, some two hundred years earlier, had hung weights from the fixed extensions of a loosely pivoted parallelogram and achieved an unexpected equilibrium. (See pages 127-134, and page 1639.)

Most people, in making such equipment, followed that precept of weighing, well established by centuries of use of the beamscale, bismar and steelyard, that your device, whatever else it may do, shall indicate a state of correct equilibrium by balancing in a horizontal position.

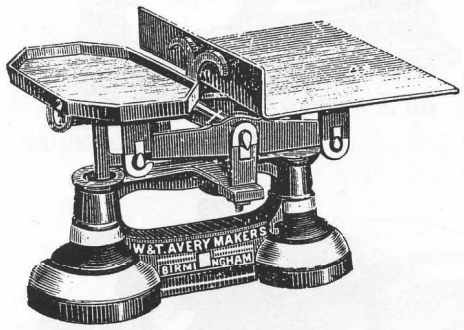


Fig. 4. W & T Avery Ltd, 1898. 'Very Superior Anglo-French Parcel Weighing Machine.' London pattern roberval scale, made to vibrate. Avery's only vibrating London design at this date. Capacity 7lbs to 28lbs. Thousands supplied to the GPO.

For some reason, some British manufacturers decided that, whilst this principle was fine for the accurate weighing associated with equal-arm balances and beamscales, it was not altogether appropriate to the everyday type of transaction conducted with counter machines.

It may have been an example of an early marketing ploy, recognising the customer's desire for a bargain when buying, that produced a type of weighing machine that 'turns' when the correct weight is achieved and thus indicates that good weight is being supplied, when it is in fact merely adequate.

Whatever the reason for its development, the so-called accelerating machine appears to have had a wide acceptance in Britain in the nineteenth century, and counter machines operating on this principle were made in both the conventional form and the inverted or imperial configuration, (Fig. 7.)

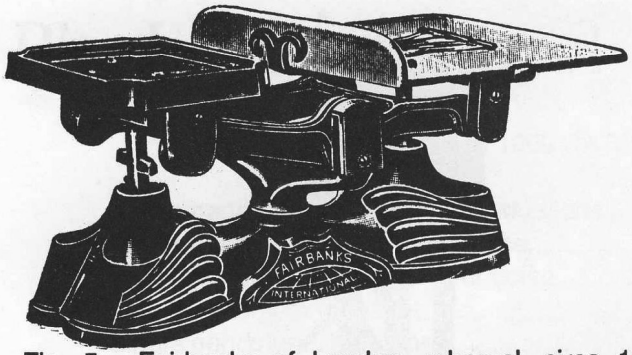


Fig. 5. Fairbanks of London, roberval, circa 1915. International, registered design number 492659. *'Fitted with our new balancing box & a new graduated beam.'* The beam looks like a normal, robust beam and shows no sign of any graduations. All counter scales had to vibrate after the 1907 regulations were made mandatory. Capacity 10lbs to 30lbs.

An accelerating machine is simply one in which the weighing element is in a state of unstable equilibrium and indicates the attainment of 'balance' by moving from its state of initial rest to a second one rather than hovering midway between the two.

As far as British counter machines were concerned, in the 19th century there was co-existence between the accelerating (or London) patterns and the vibrating (or French) patterns. The first identified example of a London roberval pattern's being designed to vibrate appeared in the Day & Millward catalogue of 1889, in which Day & Millward stated that one only of their London patterns '*can be made to vibrate.*' W & T Avery Ltd only offered one vibrating example in their 1898 catalogue, as the Anglo-French Parcel Weighing Machine, (Fig. 4.)

There is, of course, no reason for an indicator of any sort on an unstable beam, as it serves no role in judging the system's displacement, so pointerless machines were commonplace at this time.

This then was the situation that existed at the turn of the century when the legislators took a hand in the design of counter machines. Under the Regulations of 1907, the controls extending to counter machines included the prohibition of the accelerating principle, so thereafter we joined the rest of the world in having scales that balanced.

It would seem, however, that the basic form of the counter machine had been set by the time this official interference occurred.

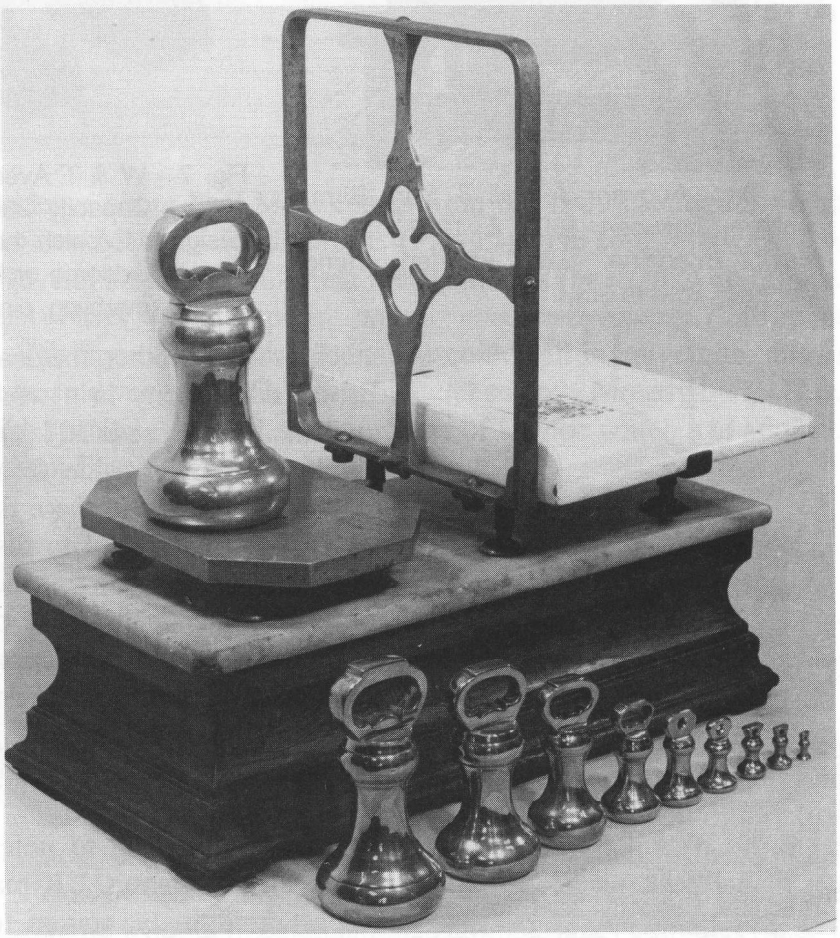


Fig. 6. W & T Avery Ltd, Imperium, shown in the 1909 catalogue, a beranger with a back rest against which a paper bag or a sack could be leant whilst it was filled by the shop keeper. Capacity 30lb to 60lb. Vibrating, to conform with the 1907 regulations. Not to be confused with an Imperial inverted roberval.

The form of the stay has altered, to encompass the requirements of the stable beam, and with time the other components have been improved both in design and material. The basic form of the modern machine, however, remains remarkably similar to its ancestor and, in effect, I believe that the mazak machine still carries with it the echoes of the accelerating anachronism, to the extent that the obvious accessory of an equilibrium pointer is obstinately omitted.

The British attachment to acceleration still lingers on in the form of the counter machine's big brother, the dead-weight, (Fig. 8,) (itself a bit of British eccentricity in a world committed to proportionality once the load exceeds 30 kg.) although, even here, its days are numbered. Even aside from the obvious demise of non-graduated systems in these days of digital self-indication, in which it is often hard to distinguish the weighing machine from the cash register, our increasing association with Europe has tolled the death knell of such a perverse item as the accelerating scale. Existing machines may well continue for the foreseeable future, but I anticipate that no new ones will be made and the breed will join the other extinct species eventually.

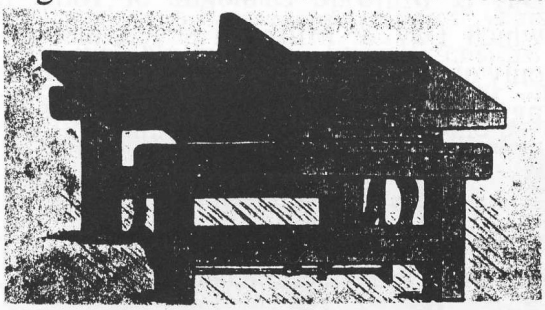


Fig. 8a. Above. J. Hall & Son, Birmingham, between 1893 & 1907. Dead weight machine, with wooden frame. Capacity 2cwt to 3cwt.

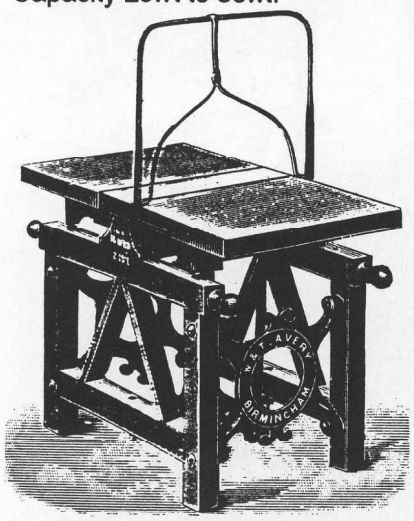


Fig. 8b. W & T Avery Ltd, 1909. Dead weight table (counter) machine, capacity 2cwt, to weigh cloth, or for tea dealers. Centre platform fixed to frame.

Fig. 7. W & T Avery , Imperial roberval machine, circa 1880. Capacity 28lbs to 112lbs. These scales were designed to catch the eye of the customer, so there were many handsome or frivolous variations; - statues of bulls or lions, marbling, pink lustre, Corinthian columns, etc.

It is also interesting to note that, as a direct result of our European association, UK manufacturers have at long last, I suspect grudgingly, started to make counter machines with pointers.

Ph. J. Maul Part 2

By D F CRAWFORTH-HITCHINS

MAUL'S 1909 CATALOGUE ANALYSED.

Single pendulum with moving graduations	224	
Single pendulum with moving poise	53	
Single pendulum with turn-over poise	72	
Single pendulum for paper	13	
Single pendulum , hand-held	16	
Single pendulum for photo/chemicals	70	516
Circular pendulum	8	
Fertig	34	
Single pendulum with turn-over poise for photo/chemicals	28	
Bilateral pendulum	45	54
Bilateral pendulum for photo/chemicals	9	
Unequal arm, fixed poise scale	15	
Waistcoat pocket scale	6	
Roberval scale	21	
Equal-arm scale, hand-held	12	
Equal-arm scale with pillar	65	
Counter roberval scale	5	
Counter steelyard	6	
Platform scale	4	

The most substantial body of evidence about Ph J Maul comes from the 1909 catalogue, which provides interesting insights into how Maul made his profits (Fig. 15). He sold relatively few basic designs, but made each in several sizes, with different metal finishes (brass, nickel, bronze, black, lacquered, etc.), different bases (feet, tripods, wood, glass, silver, etc.) different graduations, and different pans. The figure shows clearly that he could sell massive numbers of single pendulum scales, and that he sold very few of his new bilateral scales. Already by 1909 he had massive exports to the English speaking peoples, to those parts of Europe which had adopted the metric system, and to the Russian Empire.

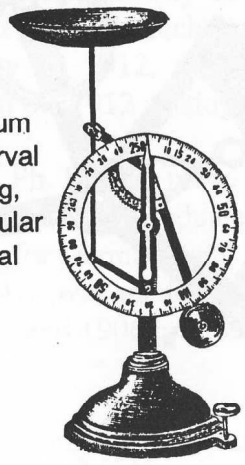


Fig. 16
Single pendulum and half-roberval with rack & cog, needing a circular chart with equal graduations.

Fig. 17. This little fixed-weight, unequal arm scale had a notice in the 1909 catalogue, *'Important. By command, you must pay attention to the fact that these scales are in accordance with the legal tariff.'*

Maul made a few oddities, including a single pendulum and half roberval,(Fig. 16,) with the pendulum attached rigidly to a rack which engaged on a central cog attached to the pointer. This permitted the graduations to be placed right round the centre without the graduations getting larger or smaller (as in a normal pendulum scale). So can this be called a bent lever scale?

Ph. J. Maul also sold a quaint little half roberval combined with a fixed poise on an unequal arm which ended in a pointer (Fig. 17). The balance was drawn for the catalogue with a *weight* on the pan, (to illustrate that the pointer went up the curved graduated board,) but in reality, the balance was for letters. The capacity of the scale was only 15 or 20 gms, so was of limited use, being restricted to the minimum rate of the German postal rates in 1909. It was, in other words, a "go–no go" scale.

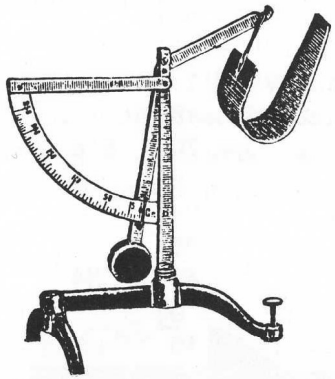


Fig. 18. Maul's second design of single pendulum, with a moving poise and pointer.

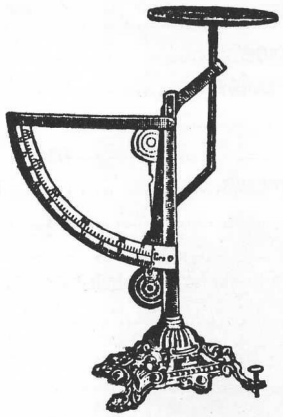


Fig. 19. Maul's third version of his single pendulum, with a turn–over poise . Ornamental.

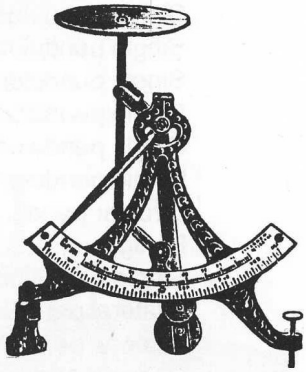


Fig. 20. Turn–over poise principle, but the poise slipped up or down the arm. Patent number 168741.

Maul made two types of single pendulum scales by 1909. He still sold enormous numbers of the 'moving graduations' version that he had made in 1892, but he now offered 'moving poise' versions,(Fig. 18,) on which the arm (that was fixed rigidly to the load hanger,) had on it both the poise and the pointer, so that, as the hanger descended, the pointer went up past the fixed graduation board. This principle allowed the development of the turn–over poise idea,(Fig. 19 and 20.)

The turn–over poise on Maul's single pendulum scales allowed two capacities on the one graduation board (most clearly shown in Fig. 20.) The turn–over poise worked on the principle that a poise nearer to the central pivot was pushed right up the graduated board by a lighter load, whereas a poise further from the central pivot was only pushed right up the graduated board by a heavier load. So, when the poise was flipped up towards the central fulcrum, the maximum load

Fig. 21.
Hand–held single pendulum.

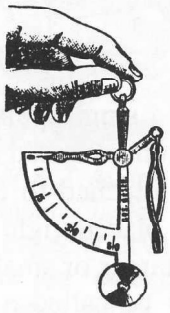
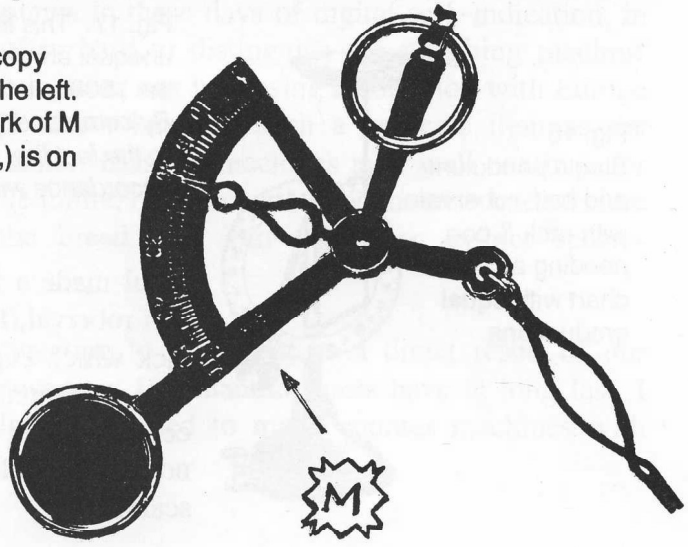


Fig. 22. Photocopy of the type on the left. Maul's trademark of M starred,(Fig. 14,) is on the arm.



was 50 gms, and when the poise was flipped down away from the central fulcrum, the maximum load was 250 gms (on model 127). On some turn-over poise designs, Maul mounted the arm holding the poise in front of the graduated board, giving easy access to turn the poise over. On some, Maul mounted the arm holding the poise behind the graduated board, and used a pull down-push up poise, which produced the same effect (Fig. 20.) Maul took out Patent number 168741 to protect his version with the graduated chart on a centrally mounted quadrant. [This scale showed clearly Maul's distinctive "scales of a fish" pattern on the cast iron, a texture used exclusively by Ph. J. Maul.]

Fig. 23a & 23b.
D R G M. 318707

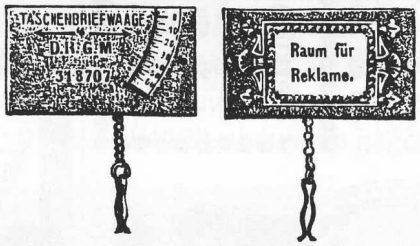
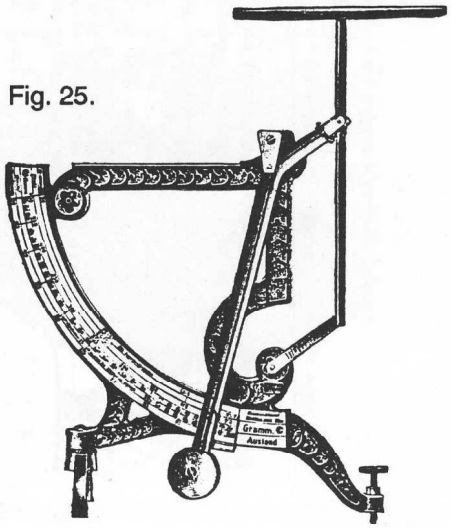


Fig. 24.
Version for the French market.

The hand scales (Fig. 21 and 22,) were very like the little hand scales made by Narcissé Briais in Paris. Only minute differences showed. The poise on Ph J Maul's scales (Fig. 22) had a ridge round the edge (normal both on Maul's single pendulums and bilateral pendulums) giving rigidity to the *pressed* brass disc, whereas Briais *machined* or *cast* the poise. The pointer on Maul hand scales had a leaf-shaped hole, whereas Briais had two circular holes. The clips were also slightly different.

The waistcoat-pocket scale (Fig. 23,) was minute;- only 5 cms by 3 cms, (2 inches by 1¼ inches.) It could be that tiny because the mechanism was so compact, being just a flat [flexure] spring attached at one end to the case and at the other end to the letter clip and the pointer. When the letter bent the spring, the pointer was pulled down the graduated chart. The scale had a window in the back, (Fig. 23b,) for advertising a name and address, or to show an appropriate picture of the town, spa, factory, workshop, etc., protected by a celluloid panel. Even with the fiddly extra card and celluloid, they were still incredibly cheap, being about half the price of the cheapest single pendulums. Presumably they were thrown away when they got dilapidated, which would explain why so few have survived. The protection provided by the DRGM (Deutches Reichs Gebrauchsmuster) 318707 seems to have been obsolete by 1912, as the numbers were specifically crossed out in the 1912 catalogue.

Fig. 25.



Surprisingly, Ph. J. Maul made very few scales with German postage rates on the graduated board. His number 401 showed rates for Germany and abroad in 1909, (Fig. 25. and his number 416 was made with the postal rates for Britain between 1897 and 1906 printed onto the letter plate, (Fig. 27 and 28.)

Maul did not put much emphasis on his double pendulum scales, leaving them until page 18 of his 1909 catalogue, (Fig. 26.) He entitled the page 'Columbus', the

Fig. 26. Page 18 and 19 of Maul's 1909 catalogue.

Doppelhebelbriefwaagen Columbus

D. R.-P. 112860 und 120187 und viele Auslandspatente.

Beste Briefwaage für den Privatgebrauch

Gesetzlich geschützt

Die Waagen stehen auch auf geneigter Fläche immer auf Null, sie bedürfen daher keiner Stellschraube.

Fig. No. 403

Mit gestanztem Fuss Waage aus Eisen, vernickelt	No.	Tragkraft: Gramm	engl. Ounces	russ. Loth	M.
Fuss und Stativ schwarz lackiert	405	60	2½	6	7.50
Fuss und Stativ grün lackiert mit Gold	407	60	2½	6	8.—
Fuss und Stativ schwarz lackiert	415	100	4	8	10.50
Fuss und Stativ grün lackiert mit Gold	420	100	4	8	11.—

Fig. No. 404 Höhe 11 cm

Mit gusseisernem Fuss:

Tragkraft: 60 Gramm, 2½ Ounces engl., 6 Loth russ.

in einzelne Gramm geteilt	No.	M.
Waage aus Messing, matt gebeizt, Fuss und Stativ schwarz lackiert	404	9.—
Waage aus Messing, fein vernickelt, Fuss und Stativ schwarz lackiert	406	15.—
Waage aus Messing, fein vernickelt mit fein vernickeltem Fuss	408	21.—
Waage und Fuss ganz aus Messing, fein poliert	409	24.—

Tragkraft: 100 Gramm, 4 Ounces engl., 8 Loth russ.

in einzelne Gramm geteilt	No.	M.
Waage aus Eisen, vernickelt, mit lackiertem Stativ	410	11.—
Waage aus Messing, gebeizt, mit lackiertem Stativ	411	13.80
Waage aus Messing, fein vernick., mit lack. Stativ	412	21.—
Waage und Fuss fein poliert und vernickelt	413	27.—
Waage und Fuss ganz aus Messing, fein poliert	414	30.—

Fig. No. 416 Höhe 15 cm

Tragkraft: 250 Gramm, 8 Ounces engl., 20 Loth russ.

bis 60 Gramm in einzelne Gramm geteilt

mit gusseisernem Fuss	No.	M.
Waage aus Messing, gebeizt, Fuss und Stativ lackiert	416	18.—
Waage aus Messing, fein vernickelt, Fuss und Stativ lackiert	417	24.—
Waage und Fuss fein poliert und vernickelt	418	30.—
Waage und Fuss ganz aus Messing, fein pol.	419	33.—

Doppelhebelbriefwaagen Columbus

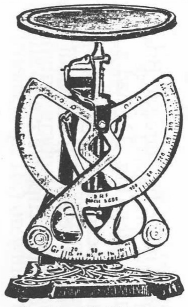


Fig. No. 421, Höhe 20 cm

Tragkraft: 500 Gramm, 16 Ounces engl., 40 Loth russ.

bis 100 Gramm in einzelne Gramm geteilt	No.	M.
Waage aus Messing matt gebeizt mit lackiertem Stativ	421	30.—
Dieselbe Waage mit muldenförmiger Schale wie Fig. 426	421/403	30.60
Dieselbe Waage fein vernickelt, mit lackiertem Stativ	422	42.—
Waage und Fuss fein poliert und vernickelt	423	60.—
Waage und Fuss aus Messing fein poliert	424	81.—

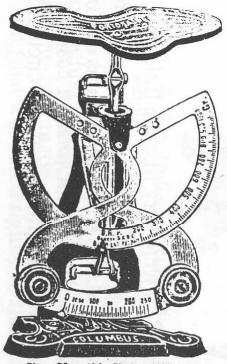


Fig. No. 426, Höhe 25½ cm

Tragkraft: 1000 Gramm

bis 250 Gramm von 5 zu 5, von da an von 10 zu 10 Gramm geteilt	No.	M.
Waage aus Messing matt gebeizt mit lackiertem Stativ	426	48.—
Dieselbe Waage fein vernickelt mit lackiertem Stativ	427	63.—
Waage und Fuss fein poliert und vernickelt	428	84.—

Versilberte „Columbus"-Briefwaagen

Hochfeine Ausführung

No. 430 =	60 Gr.	Tragkraft	M.	69.—
„ 431 =	100 „	„	„	84.—
„ 432 =	250 „	„	„	90.—
„ 433 =	500 „	„	„	144.—

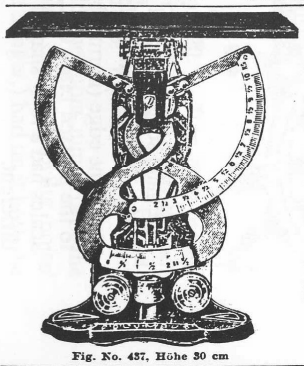


Fig. No. 437, Höhe 30 cm

Keine Federwaage!

Paketwaage Columbus.

Neuheit!

Solide! D. R. P. Genau!

Tragkraft: 10 Kilo

von 50 zu 50 Gramm geteilt.

Die Waage ist sehr kräftig gebaut, die Eisenteile sind fein lackiert und bronziert, die Messingteile sind matt gebeizt, die Skalen vernickelt.

No. 437 = M. 120.— das Dutzend.

Zum schnellen Verwiegen von Postpaketen unentbehrlich.

name that he gave to the scales that conformed to his 1904 patent, but he headed the page 'D R–P 112860 and 120187', (shown previously on pages 1629 and 1630 of EQM.) Hahn's patent 112860 was to protect a relatively large scale with a very small weight pan suspended centrally below the swinging arms. The left–hand arm was extended upwards to form the pointer, with the unusual refinement of a small, finely divided chart on the pointer, to enable the user to sub–divide the units with great precision. This type of refinement suggests that the scales were intended for precision weighing, not trade weighing or letter weighing, so it is difficult for us to understand why Maul referred to this patent. I suspect that Hahn's patent was the first patent for a double pendulum scale, and that Hahn was protecting his patent rigorously, even after ten years. Maul's double pendulums (Fig. 26, left–hand side) were labelled *'These scales have an inclined surface [for the graduated chart] always at zero, thereby ensuring that no one is defrauded.'* The author has never seen a Columbus with an inclined surface and concludes that the Columbus scales shown on Fig. 26, right–hand side, are more familiar to collectors, being flat fronted, like patent number 167192 and 184690, shown on pages 1632 and 1633 of EQM.

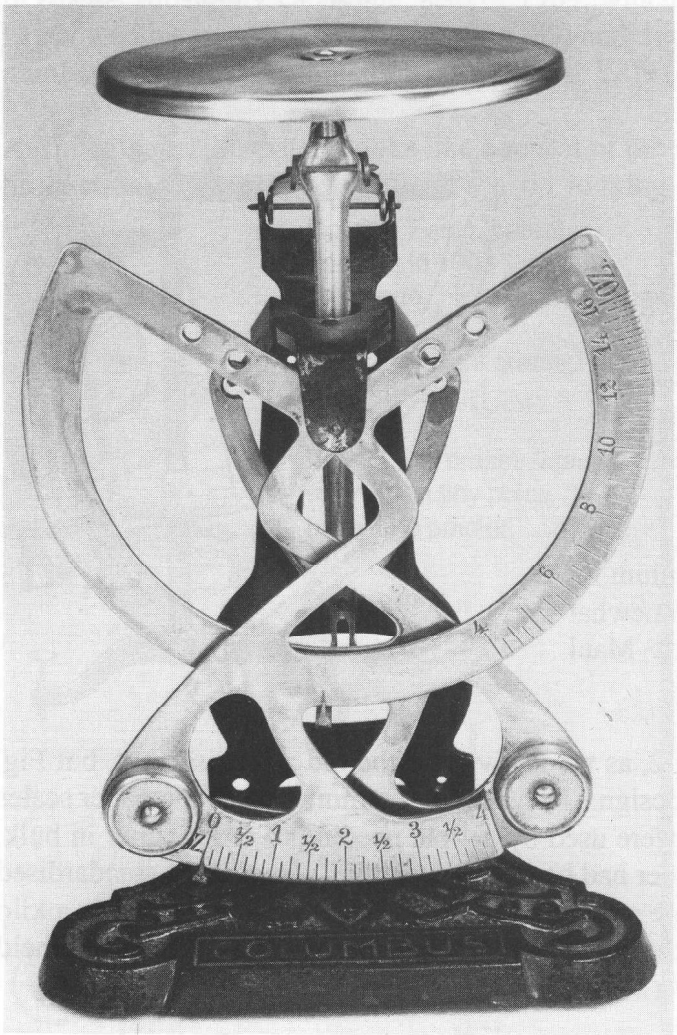
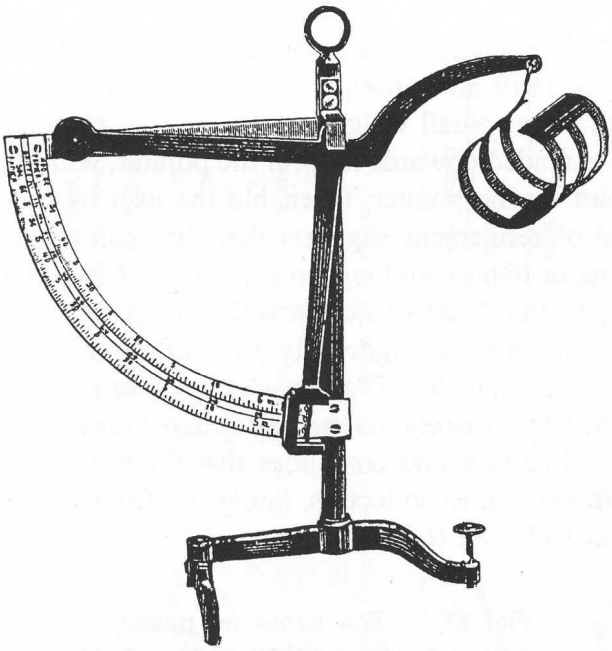


Fig. 27. The same as patent 167192, except that link (k) has been moved up to the top, to give greater rigidity to the heavier, larger scales, weighing up to 500gms, instead of up to 250gms, as shown on the patent drawing. The bearing (b) is divided into 2 short knives, so that the central column (i) does not have to be split, as shown in the patent drawing. Maul number 421.

Fig. 28. Letter rates for 1897–1915. Parcel rates for 1897–1906 so made 1897–1906.

No. 421 (top right of Fig. 26, and Fig. 27) was of medium capacity between the DRP 167192 and the 184690 and had an intermediate type of support, being of strong cast iron, but of light construction, to weigh 500 gms or 16 oz. It had an extra peg riveted into the base to prevent the arms from being distorted by backward pressure when in transit. The 426 was of heavier



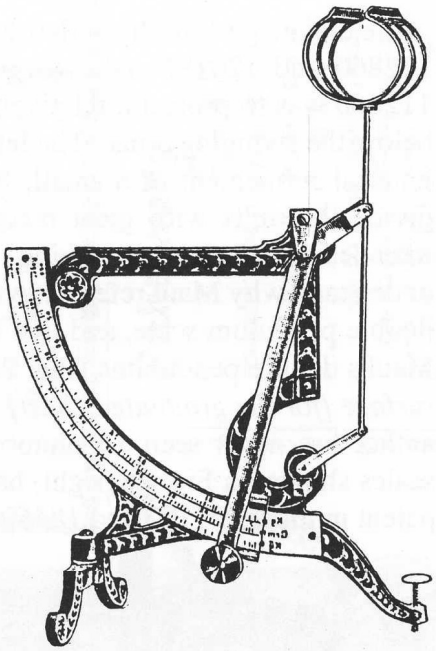
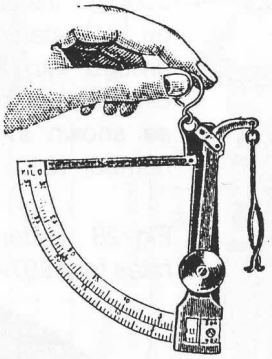
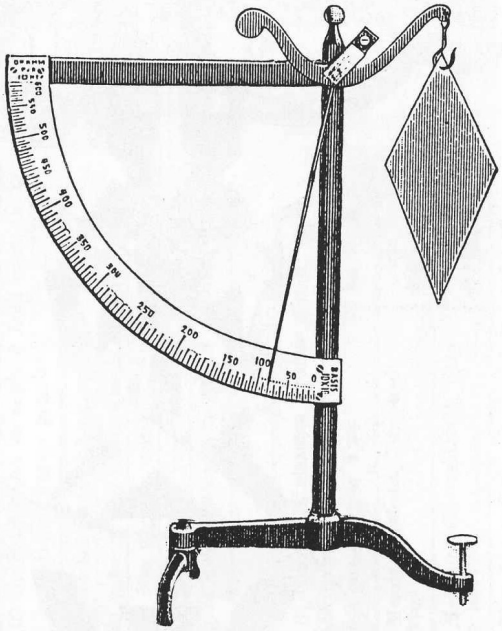


Fig. 29. Paper scales.





construction to weigh 1 kilo or 2 lb., and the 437 was the full DRP 184690 type to weigh 10 kilos (about 20 lb.). The author would like to know the purpose of the knob/drum mounted at the front of the base of number 437, shown at the bottom right of Fig. 26. Is it an ink bottle?

Maul offered eight variations of single pendulum on ink–stands and pen–racks, all looking somewhat ungainly and inappropriately pushed together. Maul advertised them as "ornamental".

Paper scales were already being made in 1892, as we know from the old advertisement, but Fig. 29 is the first evidence that we have of their design. They are very reminiscent of the paper scales made by Louis Schopper of Leipzig. They were used by people needing to order paper in bulk, but who did not know what their previous order had been. By weighing a sample of standardised size, as shown hanging on the hook of the one at the bottom right, the number of sheets in a kilo or a ream could be ascertained and thus, the thickness of the paper known. The hand–held version was also available as a yarn–weighing scale in a cloth–covered pocket (etui.)

Maul offered his normal single pendulums for various purposes – chemists, apothecaries, photographers, and cooks – by the simple expedient of making pans bigger or smaller, or by making the pans of inert substances like glass, celluloid or aluminium.

Fig. 30. Table scale, not for trade use.

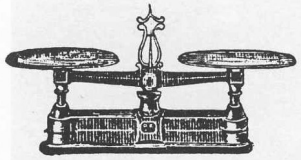


Fig. 31. Parcel scale.

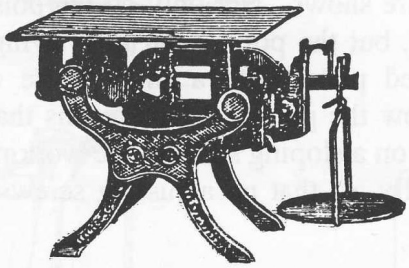
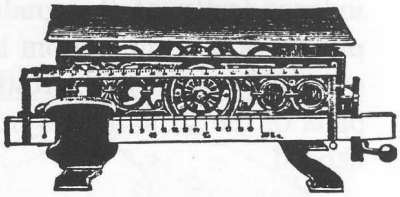


Fig. 32. Parcel scales.



He offered only one counter roberval, not for trade use (Fig. 30) and one decimal counting scale (Fig. 31), presumably bought from another manufacturer, and one chunky scale (Fig. 32) with 25 kilo capacity reading off in gross weight. A German speciality was Maul's single pendulum for weighing asparagus. He sold two platform scale for parcels.

In Maul's subsidiary catalogue, also of 1909, which was concerned with his stationery products, he showed his new "Fertig" design (Fig. 33) and described it as '*Patent Applied For*.' The Patent, number 228054, was granted on 28th August 1909 (Fig. 34).

At first glance, this patent looks like a repeat of the single pendulum postal scale that had been in production for many years, and even on looking at a real Fertig scale, it still looks like an

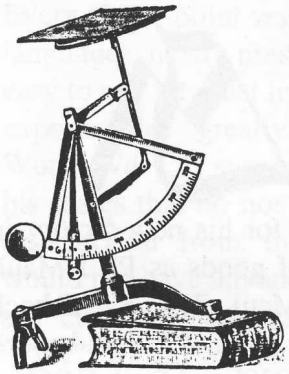
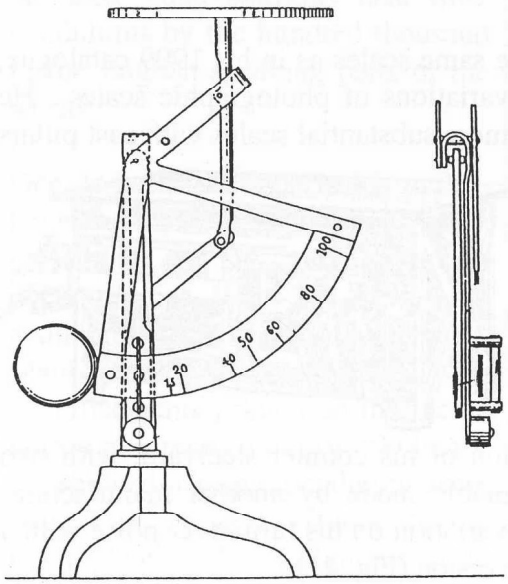
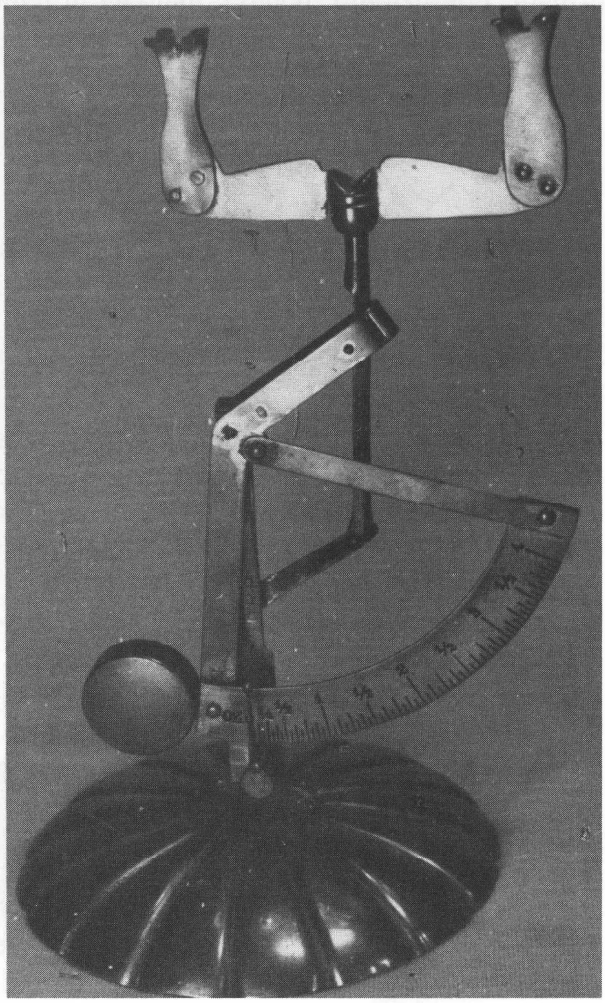


Fig. 33. Fertig, patent pending in 1909 catalogue. ←

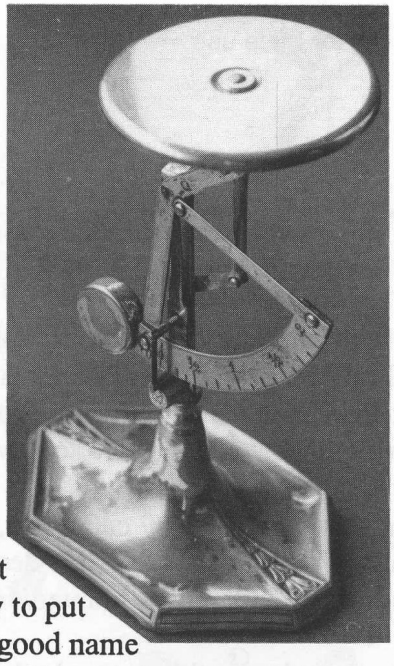
Fig. 34. Patent granted August 1909. ↓

Fig. 35. All brass. 'Maul starred' on tiny poise below the pointer. →





ordinary cheap little postal pendulum. However, as soon as one tips the Fertig, the clever feature shows. Not only do the poise and the graduated plate swing, but the pointer bar also swings independently of the graduated plate, with a small poise or plumb–bob at the bottom below the pointer. This means that, even when the Fertig is resting on a sloping surface, the working parts of the scale hang vertically, so that no adjusting screw is needed.

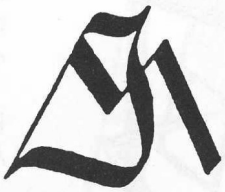


This modification allowed Ph. J. Maul to use decorative bases without a crude screw at one side. Over the years, he produced all sorts of variations, some beautiful and some bizarre, (Fig. 35 and 36,) but all boosting his sales. Any collector can identify his Fertigs instantly, by looking for the plumb–bob poise.

Although Ph J Maul patented the Fertig *design* in 1909, he did not protect the *name* until 1912, when he took out Fig 37 specifically to put on letter scales. "Fertig" meant quick or dexterous in German, a good name for a self–levelling, instantly–read scale. The trade mark was valued by the company, and the protection was maintained until 1932.

Fig. 37
Protected
June 1912.

Fig. 38.
Protected
Sept. 1912.



In parenthesis, it was in 1912 that Jakob Maul got a trademark (Fig 38) for his new factory in Hamburg, Wandsbekerstieg 35, where he was making the same range of goods as Ph J Maul. The trademark book was annotated on 13th June 1932 "Firma Jakob Maul, Zell, Kr. Erbach (Odenwald)" although he moved to Zell before 1926, the year that he registered his trademark JMAZ [Jakob Maul Aus Zell] and, subsequently, Macito (1932), Maulit (1939) and Puck (1966).

In the 1912 catalogue Ph J Maul advertised very much the same scales as in his 1909 catalogue, although the emphasis changed. He made many more variations of photographic scales. He extended the principles on which the Fertig worked to his more substantial scales with cast pillars

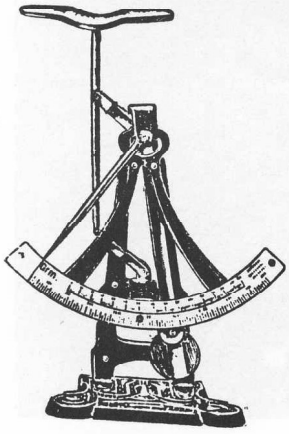
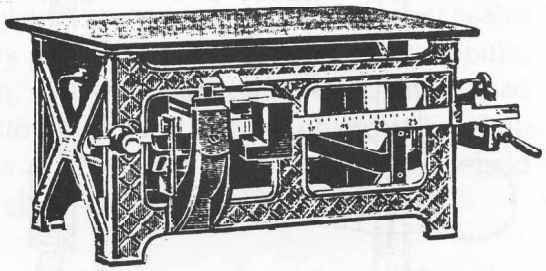


Fig. 39. Covered by patent number 168741, but a more rugged version.

Fig. 40.>



(Fig 39). He offered a variation of his counter steelyard, with two beams across the front, presumably made by another manufacturer (Fig. 40), and offered one new variation on his turn–over poise with a cast frame:– the wall mounted version (Fig. 41).

Fig. 41. A variation of Fig. 25, mounted on a wall.

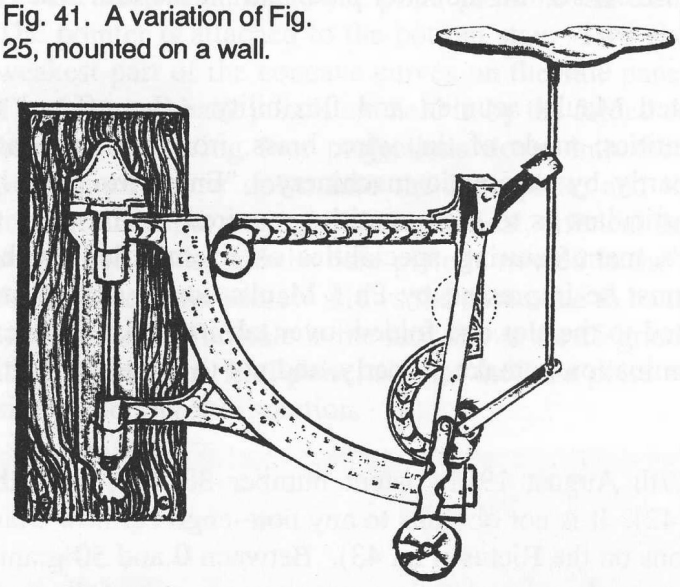
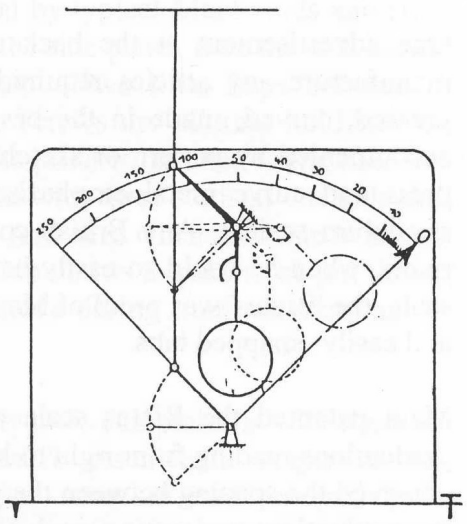


Fig. 42. Rictus, patent number 384478.



Although Maul had always offered his scales in grams, ounces and Russian loths, his catalogues were written in German and were consequently very difficult for foreign customers to use without struggling with a dictionary for many hours. Some time between 1912 and 1921, Maul published a comprehensive export catalogue, written in German, French, English and Spanish. Every single point was made in all 4 languages, neatly presented and very easy to use. It must have boosted his export sales greatly, in spite of World War I. I suspect that many of his scales that do not have his name on, survive from this period. It would not have advanced his trade to say clearly "Made in Germany" or "PJM", so he just used "Columbus" or "DRP" and sold his neat little pendulums by the hundred thousand in the English speaking parts of the world.

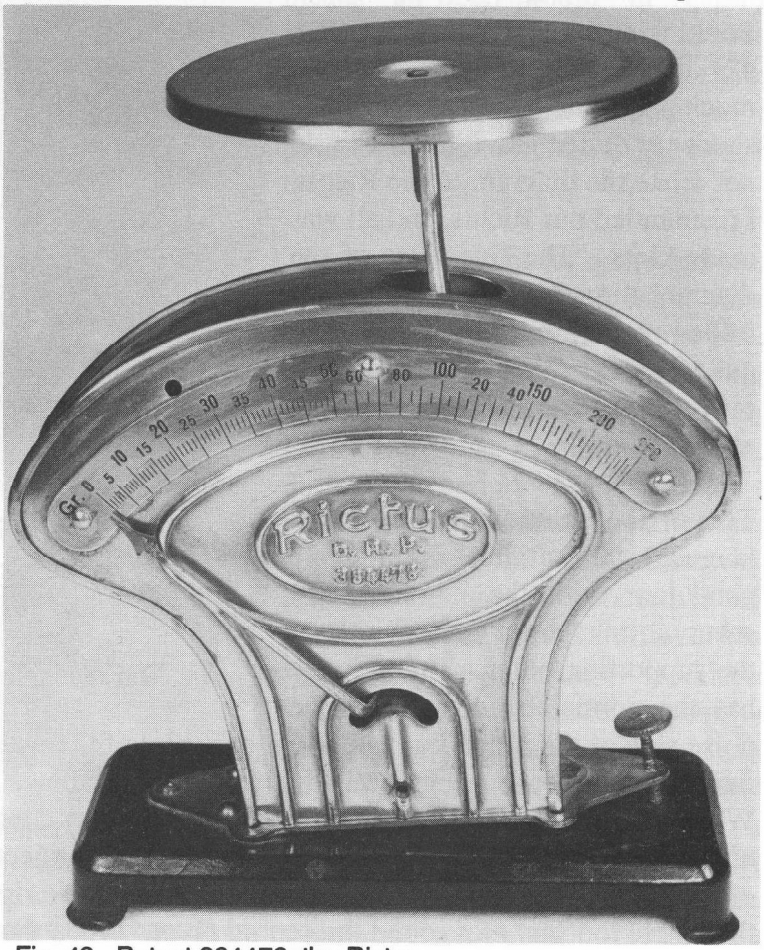


Fig. 43. Patent 384478, the Rictus.

One or two variations in his multi-language catalogue are worth mentioning. His tiny waistcoat pocket scales (Fig. 23) were now available with a mirror on the back. Maul would supply articles with advertisements printed on the nickel with a minimum order of 300 items. He showed a single pendulum scale with "P. R. Jones, Liverpool" on the letter plate, and a Columbus scale

with "A. L. LIBRO, COLISEO VIEJO 10, MEXICO" on the letter plate and on the four sides of the base.

One advertisement at the back accentuated Maul's acumen and flexibility – he offered to manufacture any articles required in quantities, made of tin, wire, brass, iron or steel, cast, pressed, curved, made in the best style partly by automatic machinery. "Enquiries must be accompanied by pattern or sketch, also particulars as to the quantities required". The offer to press and curve metal emphasised Maul's manufacturing specialities as exemplified by his pendulum scales. Any British collector must be impressed by Ph J Maul's use of screws and rivets, when he could so easily have resorted to the slot and folded–over tab instead. The next scale, the 'Rictus' was proof of Maul's determination to make properly, and not to use those brittle and easily–snapped tabs.

Maul patented the Rictus scale on the 17th August 1921, patent number 384478, with the graduations reading from right to left (Fig. 42). It is not obvious to any non–engineer how Maul achieved the spacing between the graduations on the Rictus (Fig. 43). Between 0 and 50 grams, the graduations are getting gradually more spaced out, so that the most accurate part of the scale is for objects weighing between 40 and 50 grams. Then, suddenly, the graduation between 50 and 60 grams is a quarter of the size of the previous graduation, and continues to diminish up to the limit of 250 grams (approximately 8 oz.)

Looking at the patent diagram (Fig. 42) did not help this non–engineer much. I could see that the circle suddenly defied gravity, but I could not relate the diagram to the Rictus. I dismantled our Rictus, and all was made clear. The fine lines of the diagram turned into chunky bits of folded metal, and the circle turned out to be a crude lump of lead cast over the bottom of the swinging arm, (Fig. 44.)

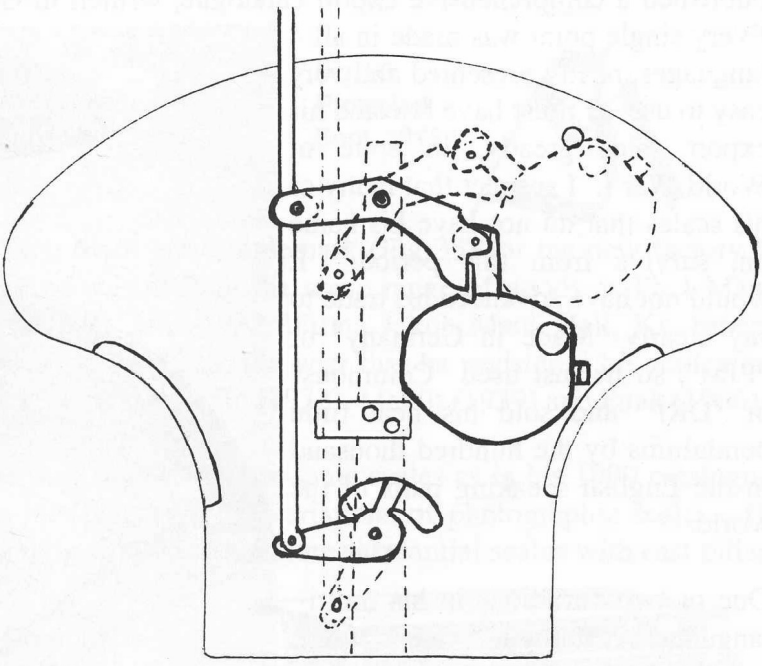


Fig. 44. The interior of the Rictus, with its 'elbow.'

To put the solution into layman's language, the Rictus is a single pendulum with the normal half–roberval linkage on the pan side of the supporting pillar. The top stay has the normal bend in it, on the poise side of the pillar, but has, about one third of the way along it, a hinge or elbow, so that the free–swinging poise hangs straight down from the elbow. This operates between 0 and 50 grams. When a heavier load is placed on the pan, the top stay continues to rise, pulling the poise up even higher, but no longer can the poise swing freely. A projection below the elbow presses on the bit of the link attached to the poise, forcing the poise into a rigid connection with the top stay, so that the whole top stay arcs round the central pivot. When the poise is thus engaged, the graduations between 50 and 250 grams are in use.

A bent strap attached to the pillar prevents the lead poise swinging against the leg of the pan. The pointer is attached to the bottom stay. Two sheets of tinned iron reinforce and protect the weakest part of the concave curves on the side panel, held on by typical Maul studs and rivets. The front and back panels are held in by the folded edges on the side panel, then the side panel is held in by having four projections down into the base plate. Two little flaps between the projections screw down into the base plate, and those two screws are all that hold the case together, another example of economical, efficient design. The pillar is fastened to the base plate with three studs, and the base plate is riveted to the iron stand with three studs at one side only. At the other side a screw allows the base plate to be tipped, to read zero when the scale is not on a level surface. The hole in the face above the 25 gram graduation allows a spike to be put through the face into the lead poise, so that the lead poise will not move during transportation; again a simple, serviceable solution.

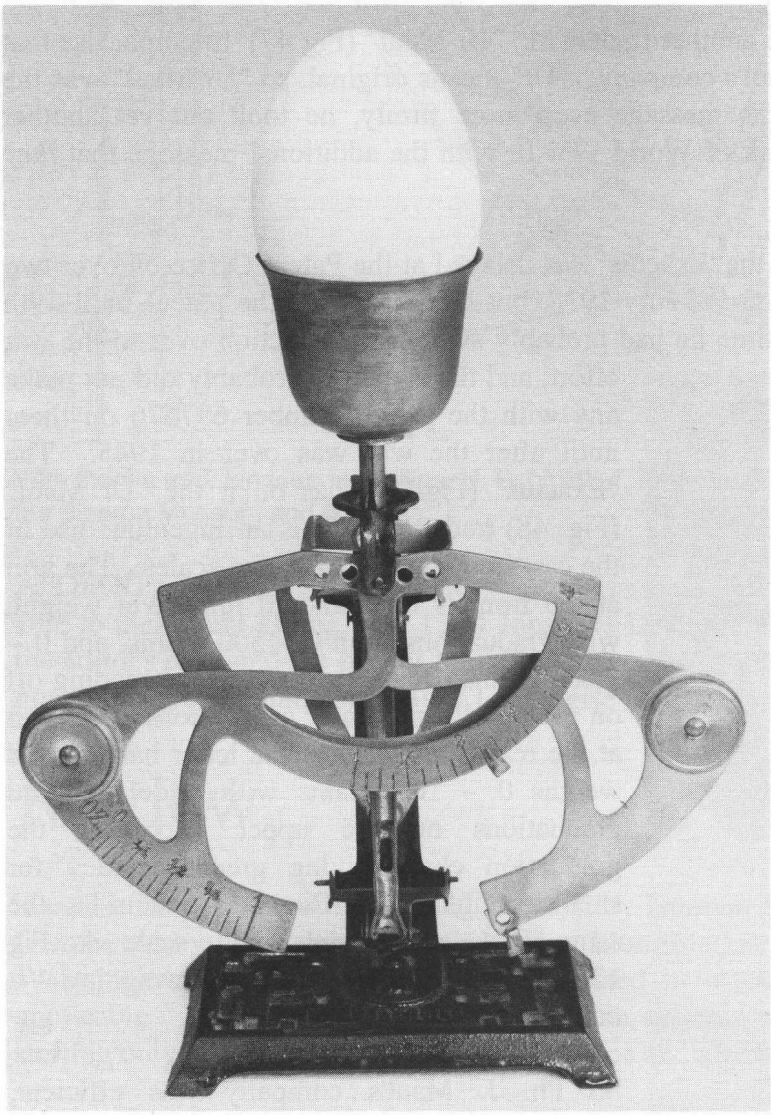


Fig. 45. Egg scale based on patent number 167192, except that the link (g) is mounted behind link (i), instead of in front of it. Also, bearing (b) is separated into two knife edges, one at the front and one at the back, so column (i) did not have to be split, as shown in the patent.

My only complaint is with the name. Maul's researchers ought to have done some market research before using a name that has unfortunate connotations in the English-speaking world, to which he sent a major part of his production. In Latin, rictus means "an open mouth" or "gaping jaws", which I suppose is not too unpleasant, but in English, rictus means "the lips drawn back in a pseudo-smile, as in the agony of death".

The company kept its name but was run by Philipp Friedrich Maul from 1928 until 1943. Friedrich must have had a very difficult time keeping the company going through the appalling Depression that Germany suffered during that period. Maul's printed a large broadsheet some time after they started to make the Rictus scale, and after the Germans had started to sell eggs by weight. Maul's offered four varieties of egg scale - a Rictus version, a single pendulum with a moving graduation, a hand-held pendulum and a turn-over poise on a cast base, none of them new in engineering terms, but interesting to the egg-scale collector. They sold a Columbus to weigh 6 cigars at a time. Amazingly, they offered a set

Fig. 46. Fig. 47. Fig. 48.

Portax URMAUL

of nesting weights, the outer weight having a lid, in traditional style.

Maul's made a fifth type of egg scale (Fig. 45), a new top on the patent 167192 (Fig 4) scale. In 1935 they even registered another trademark, Portax, to use on egg scales (Fig. 46.) This 1935 registration mentioned which street, Böckmannstrasse 34, the factory was in, for the first time in the registrations, even though Maul's had been there for decades.

In 1936 Friedrich Maul registered yet another trademark, "Ur Maul" (Fig 47), to emphasise that his company started before Jakob Maul's company. "Ur" means original, so "Ur Maul" was the "Original Maul". To drive home the message even more firmly, he took out yet another trademark six days before the outbreak of World War II, with the additional message that *they* were founded in 1874 (Fig. 48.)

Ph Friedrich Maul's attempt to patent the 'Exactus' was delayed at the Patent Office by over two years. Maul sent in the application on 5th July 1938, but he did not get the patent until 19th September 1940,(Fig. 49,) by which time he had probably switched production over to the war effort, and the company probably did not make any with the patent number 697676 on them until after the war was over in 1945. The "Exactus" (Fig. 50) has on it the "Ur Maul" (Fig. 48) trademark. It is an ingenious use of the cast iron stand to take two scales. The arm at the front is the standard turn-over weight, with graduations from 0 – 500 grams, and 0 – 2,000 grams using the top pan, and reading off on the middle and outer graduations. The arm at the rear is attached to the letter hanger, and weighs 0 – 100 grams with widely spaced graduations on the upper curve of the graduation chart, giving great accuracy for smaller weights. The Bizerba Museum has the same "Exactus" but with a little scale like Fig 12 screwed to the top, for quick weighing – a unique "three scale"!

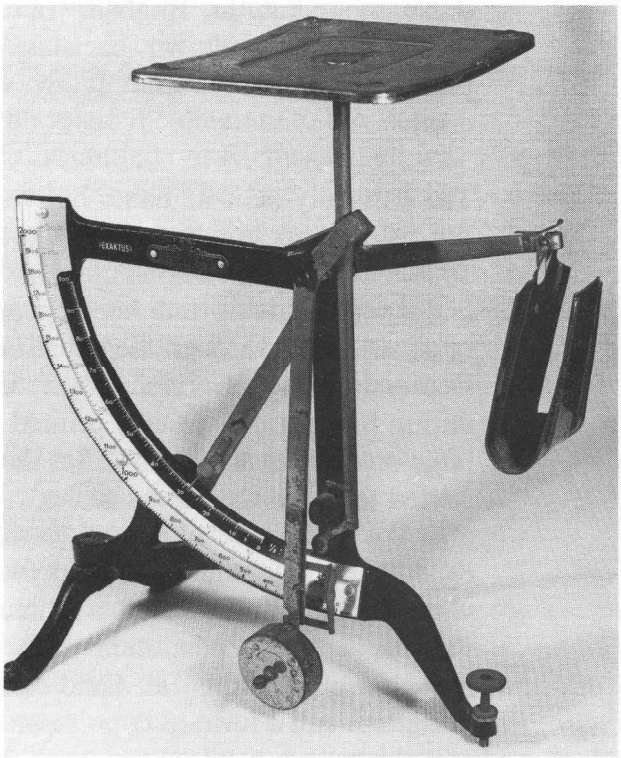
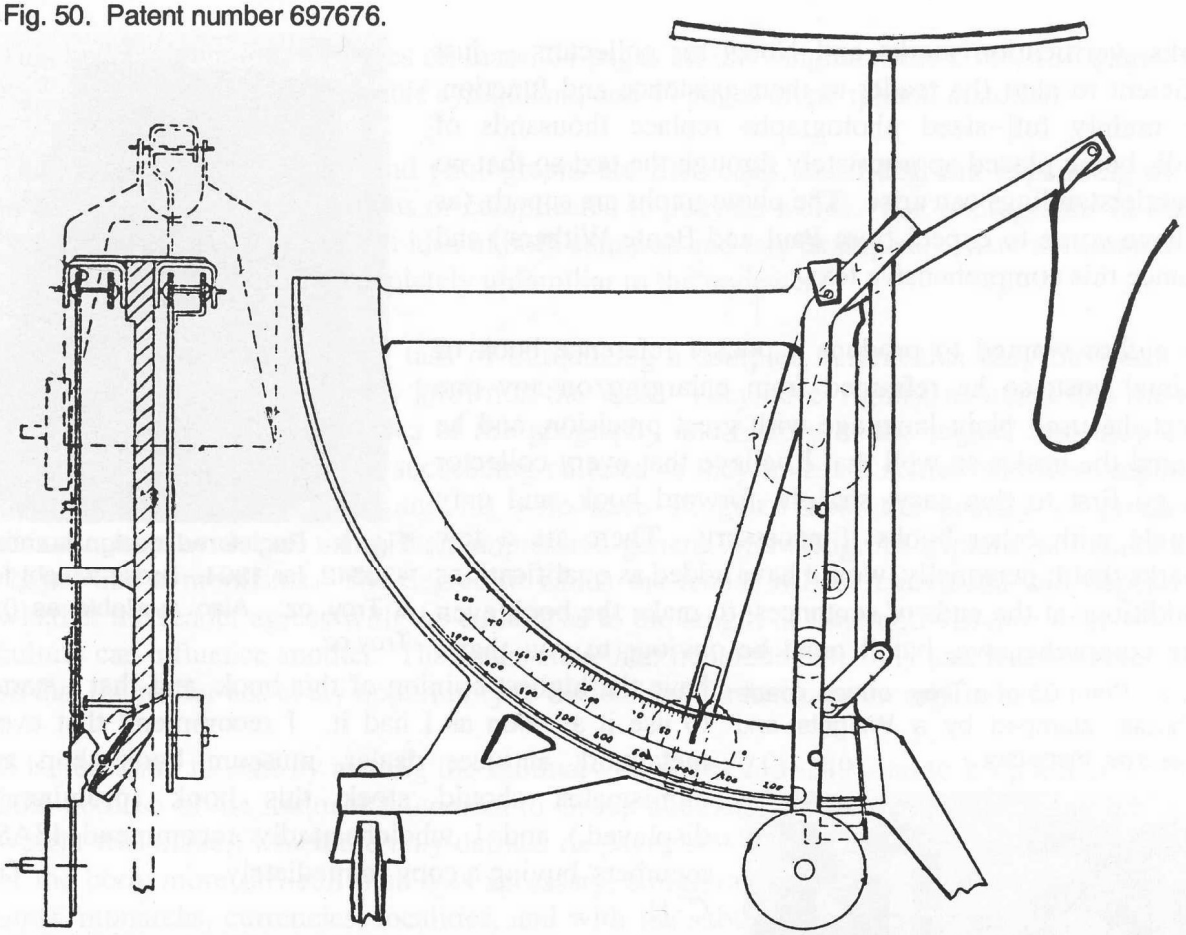


Fig. 49. The Exactus, patent number 697676.

So Ph. J. Maul's company was efficient, competitive and interesting for one hundred and fifteen years, a good record for any company.

Fig. 50. Patent number 697676.



With thanks to J. Lindner, H. Collins, U. Schmidt, J. Katz, M. Danell, B. Stein, H. Nentwich, F. Rübenthal, the Bizerba Museum and B. Brass.

APOLOGY FROM THE EDITOR

Due to inefficient gluing, Fig. 13 of Johannes Lindner's article was lost between the editor's desk and the printer in the US. Please photocopy the trade–mark and glue it (securely!) onto page 1618. I apologise for spoiling a superb article.

Review

'English Weights – an illustrated survey,' by Norman Biggs, Whitehouse Publications, 1992. Distributed by Galataprint, The Old White Lion, Market Street, Llanfyllin, Powys, SY22 5BX, Wales, Great Britain. 486 weights illustrated in black and white, both sides shown when applicable. 21 tables of weight systems, coin systems, marks, etc. 80 pages. Price retail, in sterling only, £7.50 within Britain, £8 to Europe and £8.50 to US, including packing and postage.

You might think that 486 weights could not be shown in a mere 80 pages, and leave room for a thorough text, but that would be to underestimate the concise, very methodical approach taken by the author. He divided the subject into Apothecary, Bullion, Coin, Trade and Postal Weights and then explained the key traditions and changes within each category, from the mediaeval period to the present. He put in short sections on miscellaneous weights, Local Standards and Inspectors'

Marks, verification marks and Notes for collectors – just sufficient to alert the reader to their existence and function. The mainly full–sized photographs replace thousands of words, being placed appropriately through the text so that no misunderstandings can arise. The photographs are superb, (as we have come to expect from Paul and Bente Withers,) and enhance this comprehensive text.

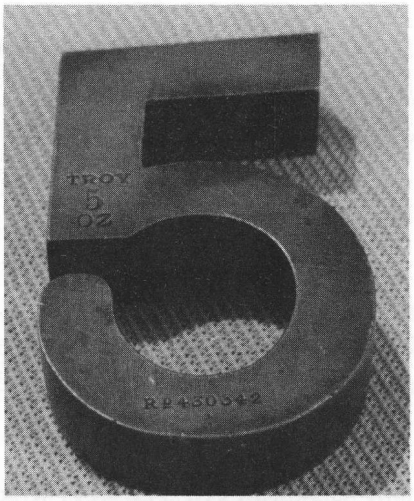
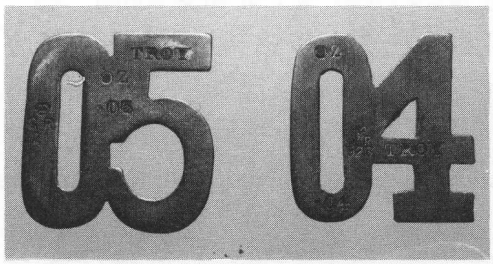


Fig. 1. Registered design number 430342, for 1904. Brass weight for 5 Troy oz. Also available as 0.5 Troy oz.

The author wanted to produce a pocket reference book of minimal cost, so he refrained from enlarging on any one aspect, he used plain language with great precision, and he covered the basics so well that I believe that every collector will go first to this easy, straight–forward book, and only struggle with other books if necessary. There are a few remarks that I, personally, would have added as qualifications or additions at the ends of sentences, to make the book even more comprehensive, but it must be obvious to you that I have the highest opinion of this book, and that I started to use it as soon as I had it. I recommend that every metalwork antiques dealer, museum book–shop and numismatist should stock this book (prominently displayed,) and I wholeheartedly recommend ISASC members' buying a copy immediately. D F C–H.

Fig. 2. Point 05 of a Troy ounce, made of brass, stamped by a Weights and Measures inspector.



In parenthesis, I recouped the cost of this book in the week that I got it, because the author had shown a type of mediaeval lead weight that was new to me. I bought the weight with confidence and delight – thankful that I had the book before the dealer had it!

Review

'Earth to Heaven, the royal animal–shaped weights of the Burmese empires,' by Donald and Joan Gear. Published by Twinstar, Harrow, England, 1992. 299 pages, 69 black and white photos, 130 diagrams, 4 maps, 24 tables, bibliography and index. Price £38, plus packing & postage as shown on your flyer.

This book covers Mass units, scales and frequencies, materials, manufacture, dimensions, shapes and decorations, signs and style systems, animal representations, identity and origins of the birds and beasts, symbolism, chronology, influences into Burma, summary, domed marble weights of Burma, unofficial weights, animal weights in Northern Siam and Laos and Malayan gambar.

This breaks down into 45 pages on mass, 64 pages on the weights themselves, 130 pages on the background cultures and possible symbolism, and 40 pages on peripheral material.

The maps, tables, drawings and photographs are first-class, clarifying and explaining so much that would otherwise be tedious or complicated to put into words. 222 photographs of bird and beast weights give an excellent idea of both common and rare examples. There are some mouth-watering weights that are completely unfamiliar to the reviewer.

The authors had the daunting task of introducing a complex culture that they obviously liked immensely, but that is scarcely known in the West. They have, rightly, assumed that the reader will only have the vaguest idea of the geography and history of the region, and they explain carefully the ebb and flow of succeeding cultures as they invaded, settled and were replaced in this beautiful country. He and his wife have struggled with the paucity of precise and documentary evidence, using their impressive general knowledge to explain particular weight shapes and symbolisms. The degree to which the reader will be convinced will depend upon whether the reader agrees with the authors as to the length of time and distance over which one culture can influence another. The Gears state their nebulous case fully and without reservations, so that the reader has every opportunity to decide how far he trusts the arguments.

It is necessary to start by reading the summary on pages 243–249, and to keep a marker in page 209, because of the frequent references to Group numbers, (periods over which any one type of weight was made,) which are only defined on pages 209–213. This delay made the first reading of the book more difficult than was necessary, struggling as one was with so many unfamiliar units, monarchs, currencies, localities, and with the subtleties of appendages and marks on the weights.

As a matter of psychology, the authors might have captured their audience more effectively if they had put the chapters on the weights at the beginning, to get the reader *wanting* to know where, why, who and when. Then the reader might have been more tolerant of the academic chapters on mass, and the preponderance of text concerning the speculation on derivation and symbolism.

The Gears wanted to be as comprehensive as possible, and in this they have succeeded, as it will obviously be a very long time before another book on the subject will take our knowledge any further. They are to be congratulated on producing such a scholarly book during such a difficult time for publishers, at such a reasonable price. The Gear system of classification will probably be adopted by all museums, as an essential tool for thought, and as a suitable memorial to 35 years of enthusiasm and hard work. D F C-H.

Joseph Béranger

By D F CRAWFORTH-HITCHINS

Joseph Béranger was born in Prissé in France in 1802. Until 1827 he was the foreman at Turpins, an important scale company. He established his own scale company in Lyon-Brotteaux in 1827, with a crowned star as his mark. In quick succession he bought up nine scale companies,

including Décrand and Turpin–Brémal, so that, at its zenith, his company employed 300 workers in eight large buildings.

Béranger et Maag patented a portable platform scale in December, 1835, with a ratio of 1/10 or 1/20, and, when applied to barge weighing on canals, with a ratio of 1/100 or 1/200. Béranger invented a decimal platform scale in 1840, with two counterpoises, (kg and hg,) for heavy weighing, with the ratio of 1/50. He patented an alteration to it in the same year, replacing the little counterpoise with a slot, and doing light weighing by reversal, that is, by putting the load on the weight pan and the weights on the load plate. Also in 1840, Béranger got a *Décision d'admission* for his roberval scales, which were sensitive to 2 parts in a thousand. In 1844 he got yet more protection for his roberval scales, as he furnished each beam with a screw thread for adjustment.

His trade–card of about 1846 particularly advertised his weighbridge, and showed the medals that he had won at the Paris Exposition Nationale. In July, 1847, the circular of the Service des Poids et Mesures admitted for verification, by Béranger et Cie, mecaniciens à Lyon, a 'pendulous scale'. This ambiguous name was, in fact, his famous modification of the roberval system. By 1848, his trade–card showed his portable decimal scale, his cattle weigher, and his small and large weighbridges, with a very long list of all the towns using his 'public weights'. Another trade–card and price list of 1848 illustrated four handsome equal–arm scales on pillars, his multiple–lever steelyard (with ratios of 1/10 or 1/100,) his rugged platform steelyard for iron–works and factories, his Béranger modification of the roberval in various guises, and weights; cylindrical, nesting and hexagonal iron weights.

As well as running his company, he was also a fervent champion of the metric system for weighing and measuring, (only adopted properly in 1840, and still avoided by the general populace for many years after that,) and he was well known for his lobbying, lectures and publications on the subject. He was also highly regarded for his far–sighted social policies, as he offered his workers free medical care, pensions and profit–sharing by 1848.

In March 1849, Béranger patented three of his scales in Britain; his steelyard platform scale, his compound lever system for shop scales and warehouse scales, and his locomotive weighing machine. Henry Pooley must have been anxious about this new competition! In 1851 he exhibited at the Great Exhibition in London. He published a catalogue, a copy of which is held by the Avery Historical Museum, in about 1851, devoted exclusively to weighbridges. Throughout his career Béranger seems to have gained most of his profits from the largest of his scales, which seems ironic, when he is now remembered for his counter scales!

In 1857, Béranger's son–in–law Catenot took over the company and he called it Catenot–Béranger. Catenot died in 1863, and his widow managed the company until she remarried M. Trayvou in 1866. Her husband took over most successfully, and Trayvou is still a working company. Joseph Béranger himself did not die until 1870.

Compiled from information in Le Système Métrique, Meten & Wegen, the catalogue of the Conservatoire National Des Arts et Métiers, the catalogue of the Great Exhibition, and private research notes.

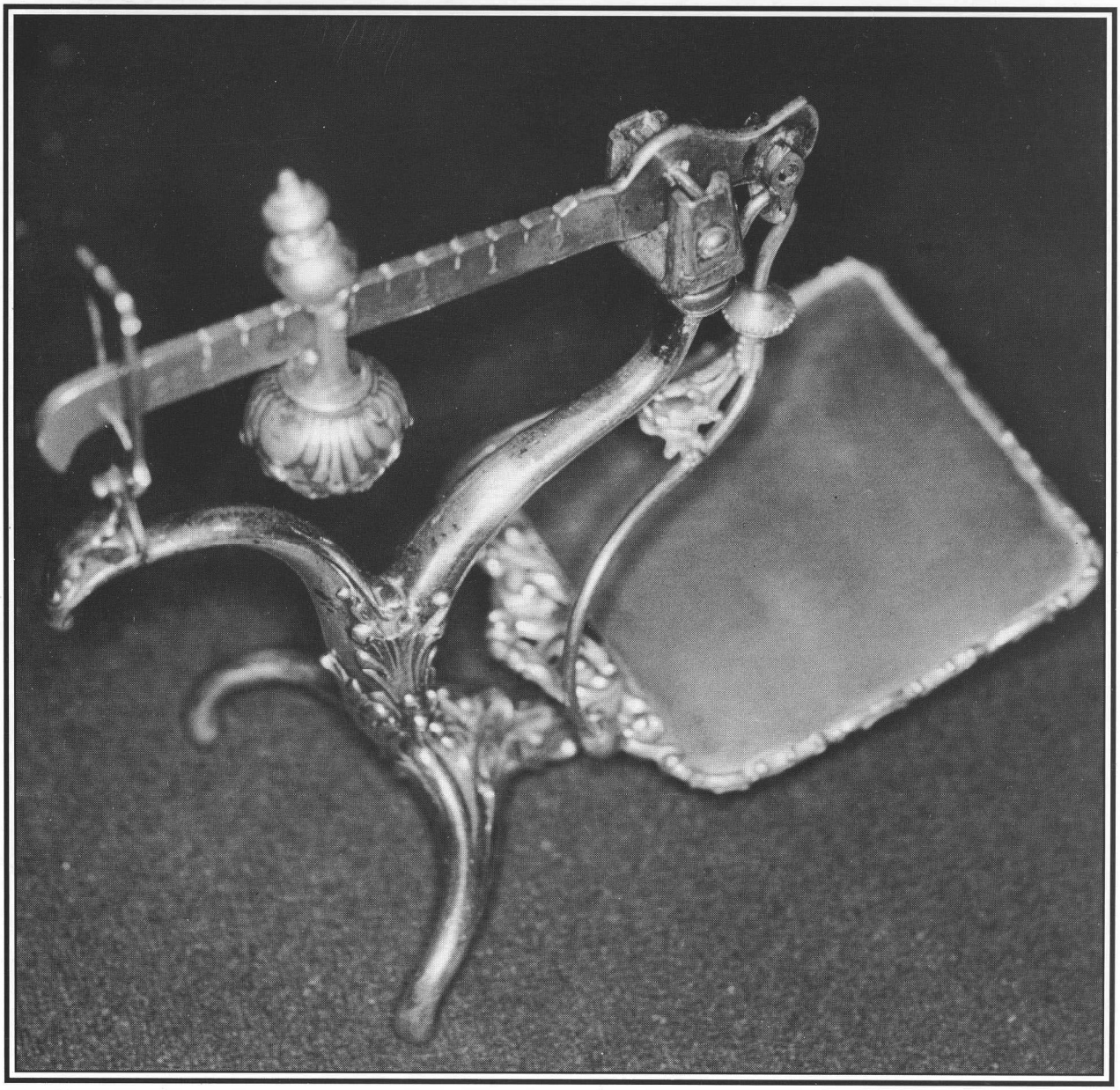
ISASC

EQUILIBRIUM®

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

1993—ISSUE NO. 2

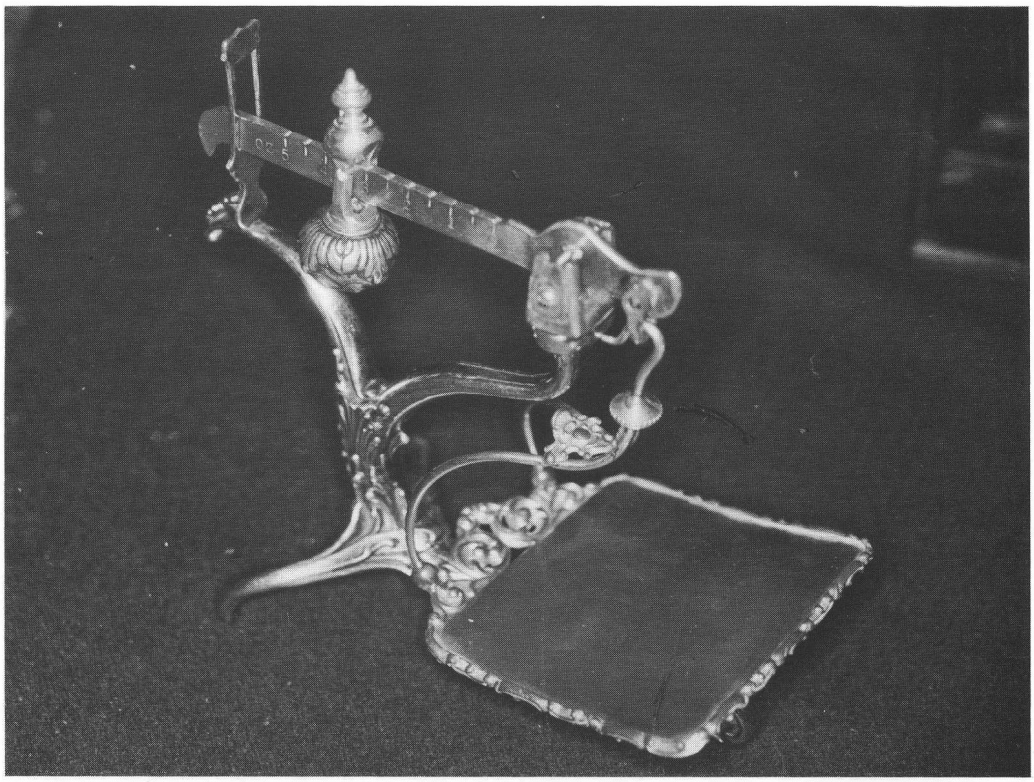
PAGES 1665-1692



Cover Picture

What is there to say about this delicious confection? It is silver plated over zinc alloy, made by Wilcox Silver Plate Co, of Meriden, Connecticut, for Fairbanks. It is a 5 oz capacity postal steelyard bought and photographed at an English antique fair. Another view of it is shown below.

B. BRASS COLLECTION



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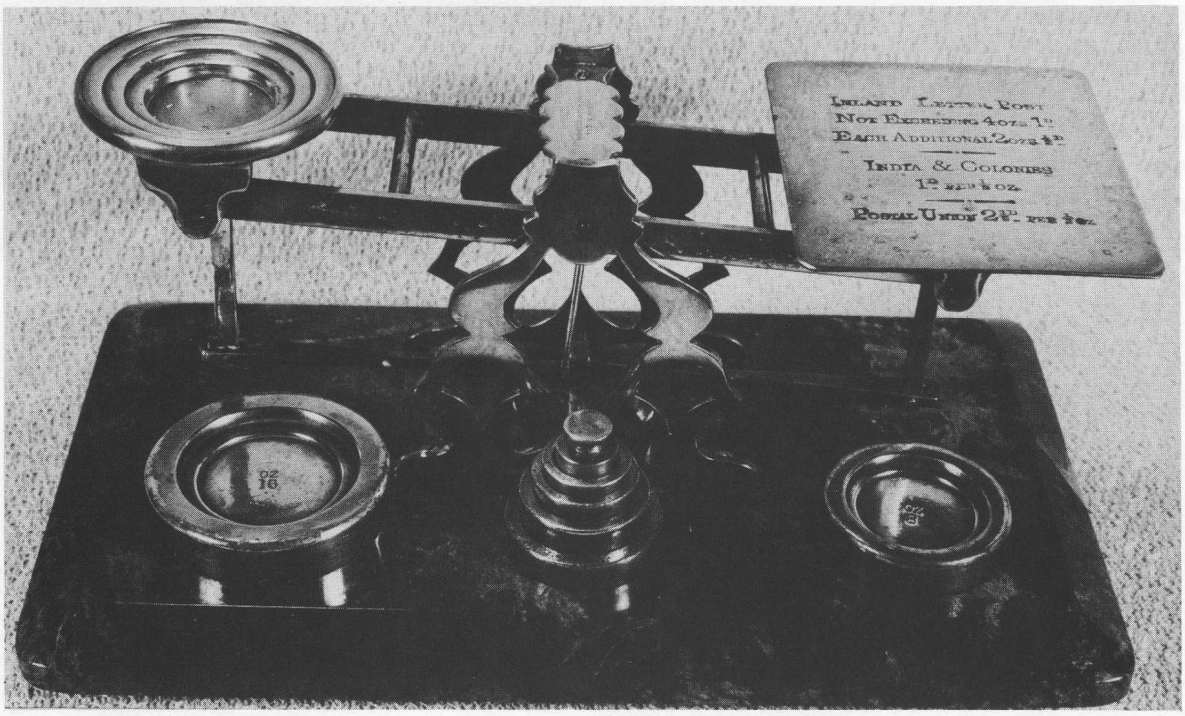
Silver Showcase

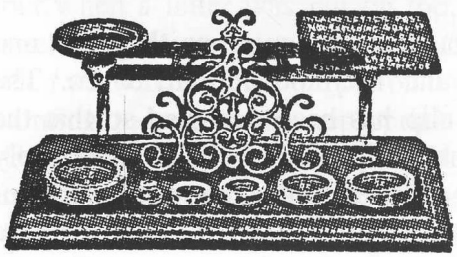
This special showcase is devoted to silver scales, and a few silver-plated scales. The period of 1895 – 1905 is particularly well covered by those examples where the owner has checked the hallmark dates, or where the patent date is on the scale.



This roberval postal scale is spectacular in reality, because the silver scale contrasts so crisply with the green marble base. The base is 11" (27.5 cm) wide, to accommodate the extra large scales, and the big weights (16, 8, 4, 2, 1, and ½ oz flat weights and a ½ oz knobbed weight on top) which are made of brass, silver plated. The weights are the classic S. Mordan design with the inner rim, and the "oz" written above the number. The plate is stamped "Inland Letter Post Not Exceeding 4 oz 1 D. Each additional 2 oz ½ D. — India and Colonies 1 D per ½ oz. — Postal Union 2½ D per ½ oz". The British colonies were at their greatest extent when this postage rate was current (1897–1915) and thousands of households had relatives stationed in Rhodesia, India, South Africa, British Guiana (South America), Hong-Kong, etc., etc. The beam is stamped "S. Mordan & Co., London" on one side and "Wilson & Gill, 139, Regent Street, London" on the other side. Wilson & Gill were only one of about 50 retailers recorded as selling Mordan scales.

B STEIN COLLECTION

Silver Balance,
with Electro-plated Weights, on Coromandel wood stand.

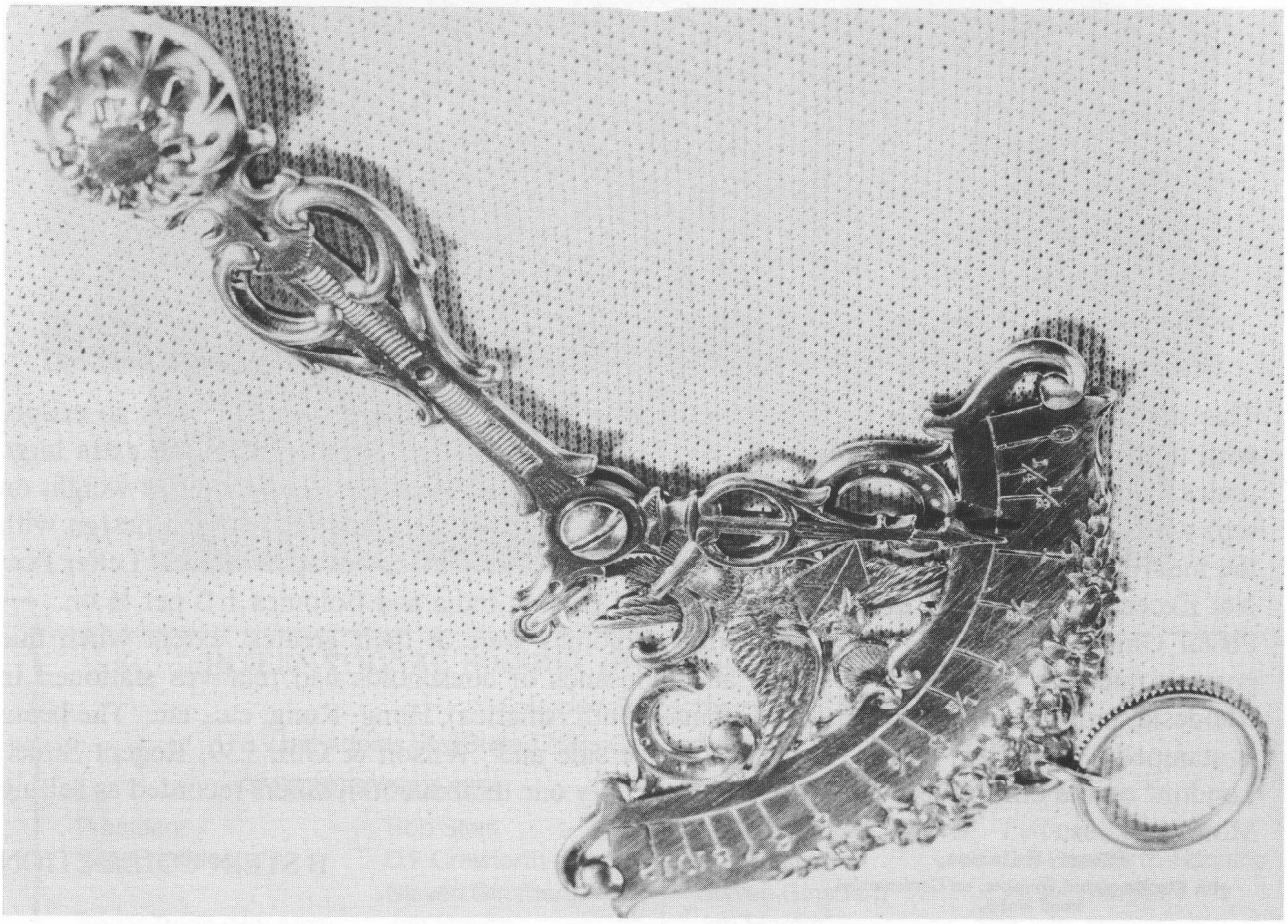


8 oz. 98/0
16 " 147/6

The Army and Navy Stores catalogue of 1907 shows another silver S. Mordan & Co. scale with the same letter plate as above, but with a highly scrolled A frame, and the weights in a line across the base. Even when new, the silver version was sixteen times more expensive than a brass version.

This roberval postal scale is another variation of S. Mordan & Co's, somewhat reminiscent of the scrolling effect of the catalogue picture., The scroll design is repeated delightfully on the A frame, the base and the plates. The base plate is raised so that the shadows underneath emphasise the fretted silver. The weights are supported in a cup fastened to the central bridge, giving easy access to them. As the surviving weight is stamped 4 oz STERLING, the assumption is that the scales were made for the American market. (For use in Britain, they would have been hall-marked only.)

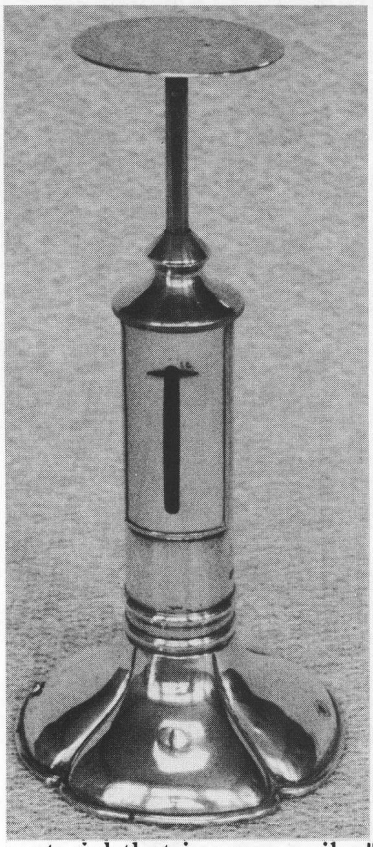
W DONIGER COLLECTION

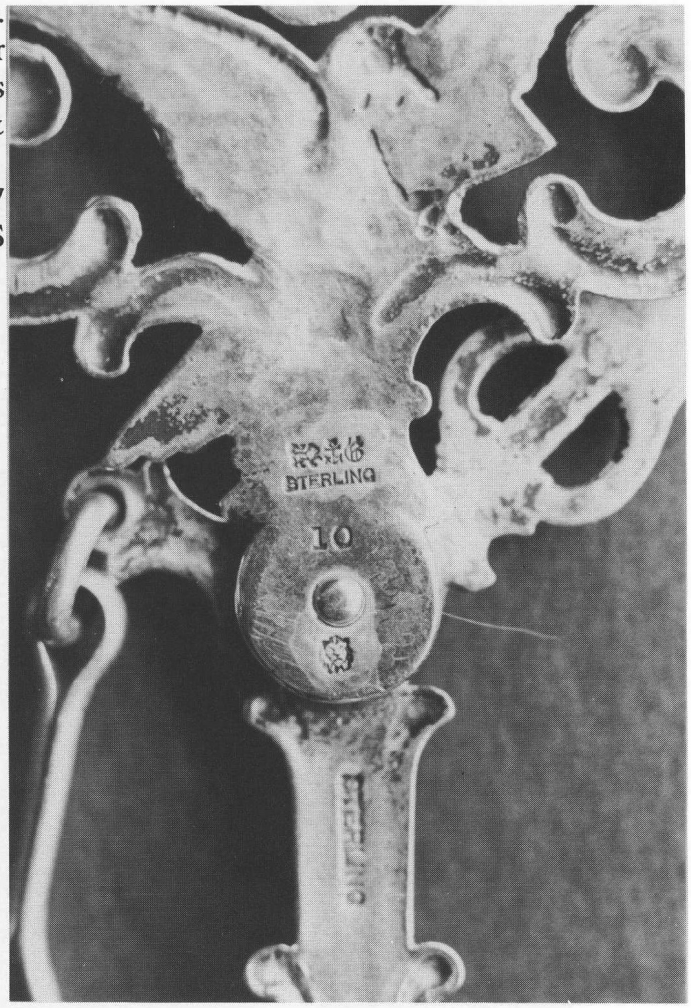


The American pendulum postal above, was made by Gorham with their mark on the back, and with the names of retailers such as 'Black, Starr and Frost' and 'Mermod, Jaccard & Co.' The capacity is 12 oz, but the angle of the weight to the letter clip has been designed so that the graduations are widely spaced for the lightest (and most commonly used) weights and closely spaced for the heaviest weights. Originally a letter clip was attached to the ring on the right of the screw. The pseudo-hallmarks imitate the lion passant of Goldsmith's Hall, the anchor of the Assay Office in Birmingham and the ornate G looks like the letter used to denote a specific year

in the British sequence of hallmarks. STERLING is the legally valid statement for solid silver in America. One has the marks for 1891, and one has the bell for 1910 & STERLING 12812.

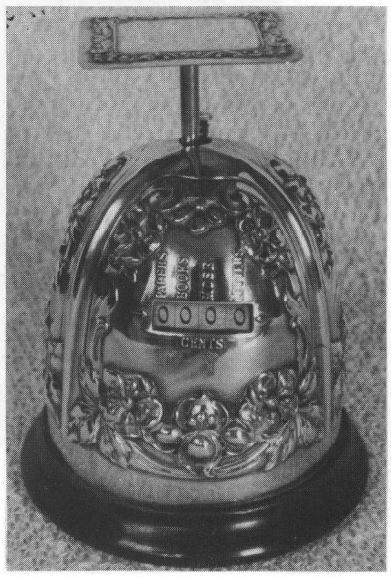
B WRIGHT, G MALLIS, J & W BERNING,&W DONIGER COLLECT'NS





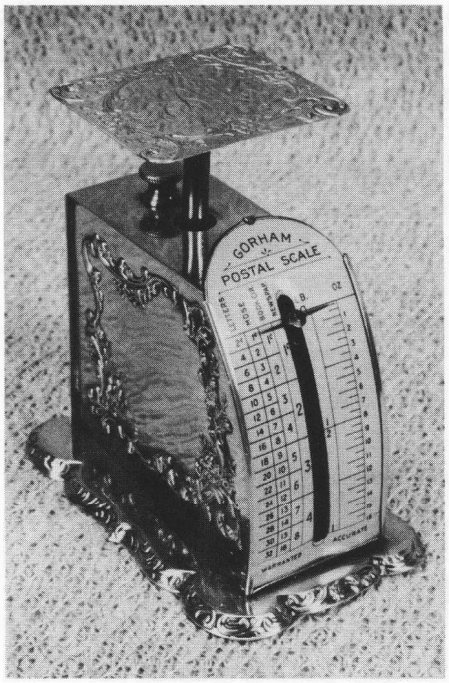
This English postal is the most recently made candlestick scale known, being of a design registered as recently as 1907. It is 6¾ inches (16 cm) high with an imitation ivory face made of celluloid, a material that is very easily "cleaned", removing the graduation markings. It is registered design number 449960, and hallmarked L & S.

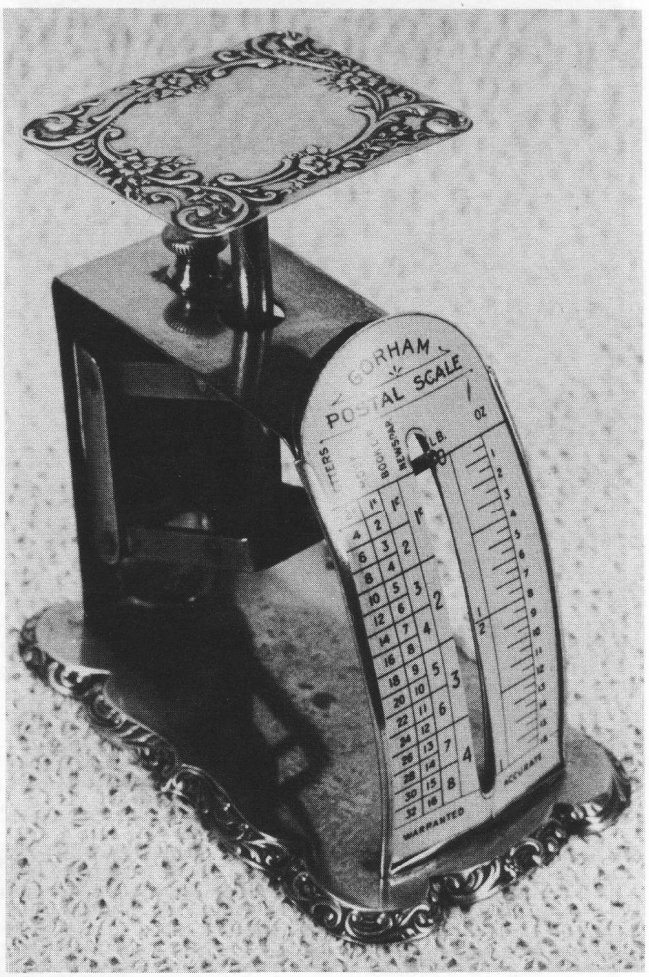
B STEIN COLLECTION



Here and on the next page is a little postal, made by Gorham, only 4 inches (10 cm) high, but shown enlarged to enhance the pretty decorative panels. The dome was cast in three panels so that the flowers could be cast in high relief without catching inside the mould. The window slot shows the internal drum at rest at zero, but when a letter was put on top, the roberval linkage dropped, stretching the spring until equilibrium was achieved, and moving the rack which turned the pinion on the drum, The drum revolved, coming to rest at the appropriate price in cents. It is marked Gorham, B. 2669, Patented 1904. The scale was placed on a heavily textured cloth to be photographed, so that the silver base looks mottled, but it is really mirror smooth.

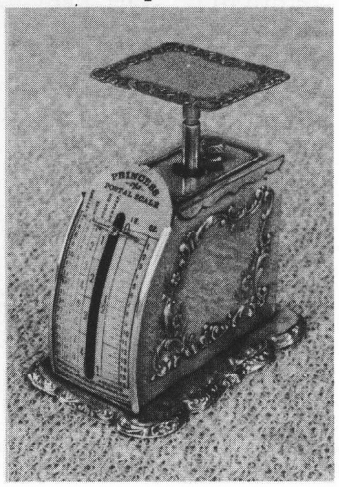
B. WRIGHT & B. STEIN COLLECTIONS





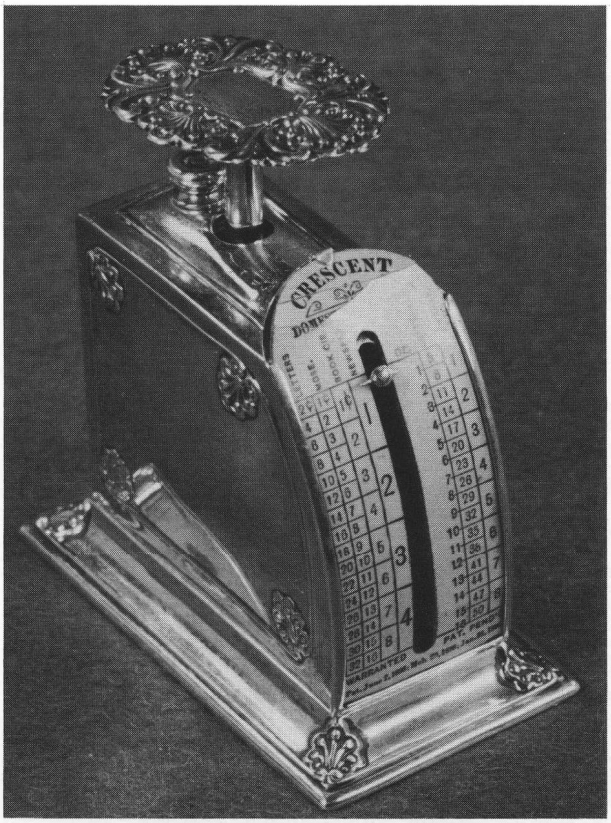
The two Gorham bow-fronts are both made using the American Gilfillan's design, patented in 1890 and, in Britain in 1896 (see EQM page 662.) They are both 3⅛ inches (8 cm) high, with a sturdy spring resistant, allowing for parcels up to 1 lb. capacity. The one shown with the greater enlargement was made with open sides so that the mechanism was exposed. It was made of sterling silver and other metals, patent pending, by Spaulding and Co. The one shown with less enlargement has embossed silver panels in the sides and a monogrammed letter plate. It has a patent date of June 2 '96.

B STEIN COLLECTION



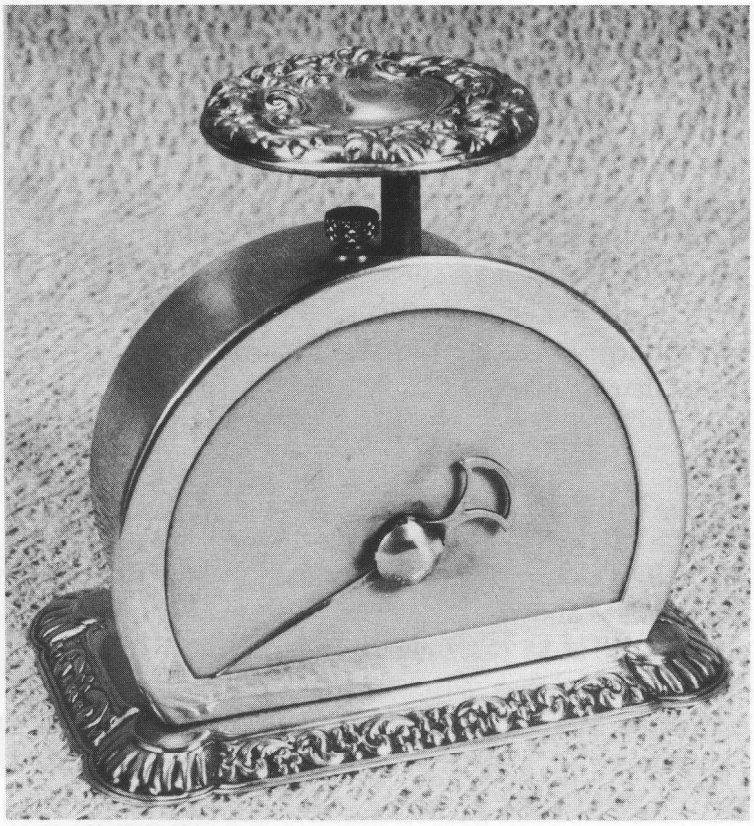
On the left is the "Princess Postal Scale, Quadruple Silver Plated. Made by Pelouze, Chicago". It uses the same internal mechanism as the scales above. The Princess was available in Brushed brass, or silver-plate at $5 each, and in Sterling silver at $9 each, so that the silver version was a reasonable option in America, unlike the expensive Mordan silver robervals shown at the beginning of this Showcase.

B STEIN COLLECTION



Pelouze made other designs with Gilfillan's mechanism. Crescent was one of Pelouze's trade names. This one is ambiguously labelled 'Pat. Pending,' and, directly underneath, 'Pat. June 2 1896; Mar 29 1898; Jan 31 189?

S GINSBERG COLLECTION

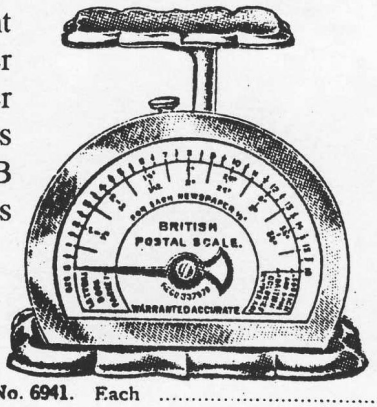


On the right is another postal by Pelouze, patented Aug 3 '97, only 3 inches (7.5 cm) high. Again the celluloid face has been cleaned, removing all traces of the graduations. It has the base design of the Countess No. 6 and the curved margin design of the Duchess, showing how Pelouze "mixed and matched" to produce varied desk scales. The nicely knurled knob under the letter-plate was to enable the user to adjust the pointer so that it touched zero accurately before starting to weigh.

B STEIN COLLECTION

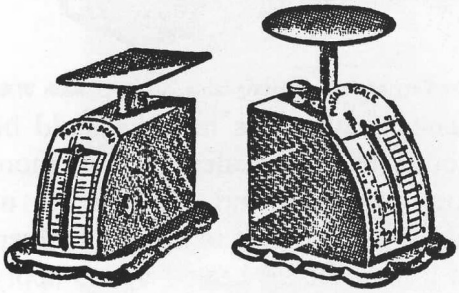
Pelouze state in their 1911 catalogue, that they "made also for Foreign Countries", and the English 'Army and Navy Stores' catalogue of 1907 provides the evidence. This elegant version of the Duchess, with its matching base and letter plate, has been registered in Britain, and allocated number 337979 (?). It was sold without Pelouze's name on it. It was extremely expensive, at 34 shillings, compared with an N B pendulum postal at 1 shilling and 8 pence, twenty times cheaper and just as practical!

SILVER LETTER BALANCE.
(Registered.)



No. 6941. Each 34/0

SILVER LETTER BALANCE.



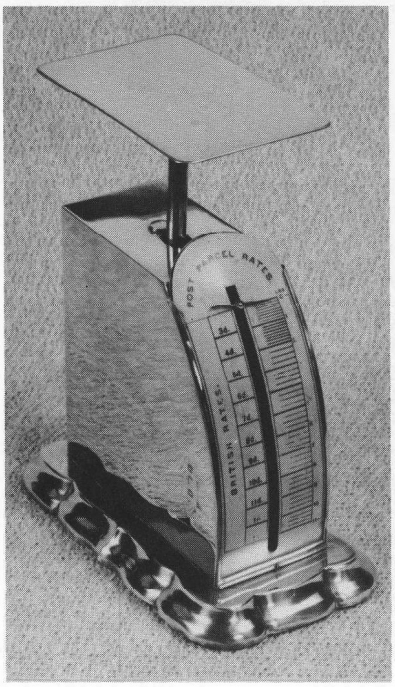
No. 1. No. 2.

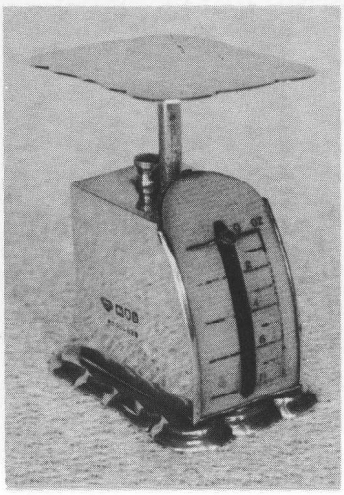
Very suitable for the writing table.

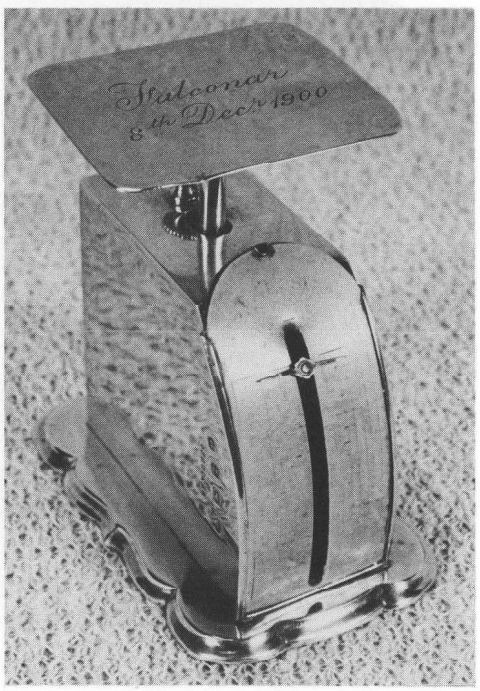
No. 1 ..... each 30/0
„ 2 ..... „ 21/0

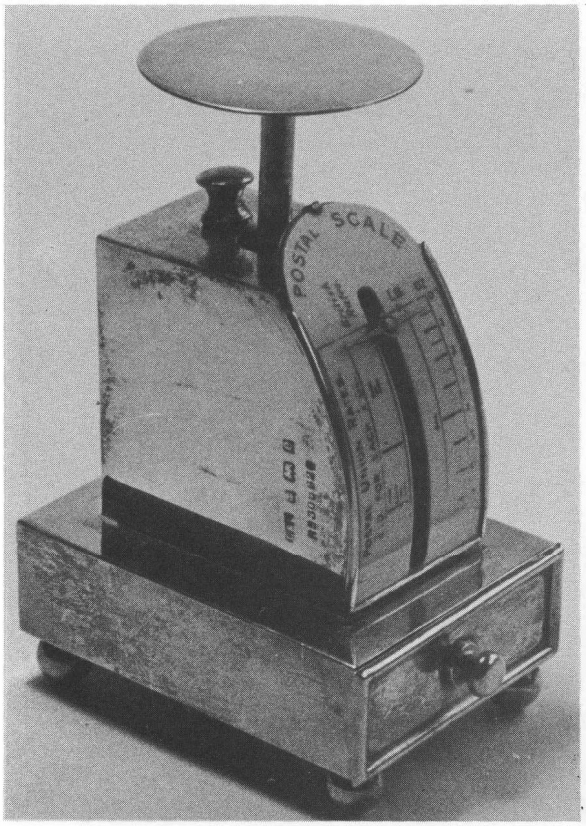
The Army and Navy Stores obviously imported large numbers of Pelouze bow-fronts, in spite of the price, as surviving examples prove. We do not know who had the responsibility for presenting them to Goldsmiths' Hall in London to be assayed, but all examples sold in Britain bear British hallmarks, as well as the registered design number, this batch being 308820 of 1897.

B STEIN COLLECTION

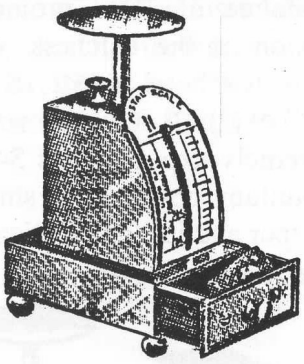








SILVER LETTER BALANCE, WITH DRAWER FOR STAMPS.



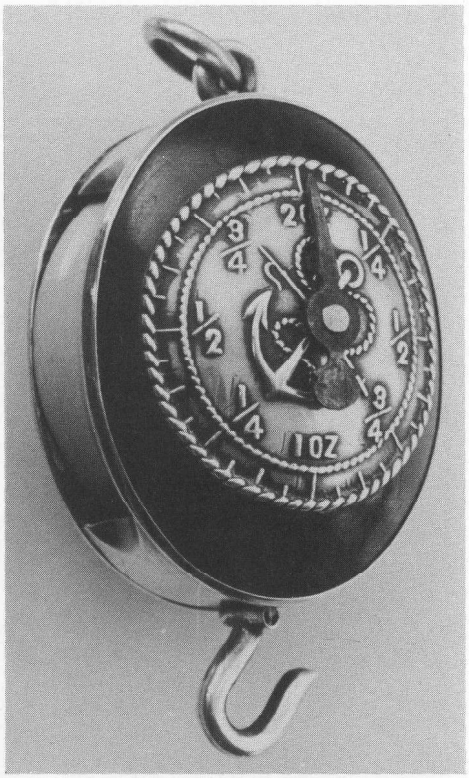
Very useful on writing table..... each 27/6

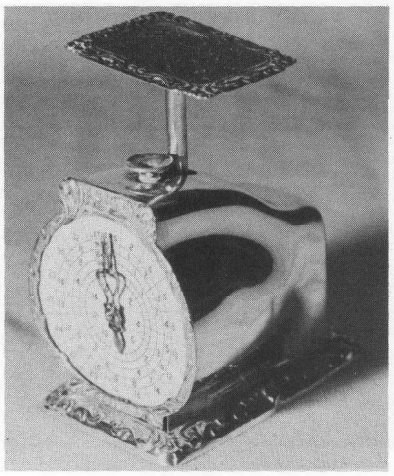
It is hard to understand why this model should be cheaper than the other Pelouze scales. It uses more silver than previous examples and it has a lot of soldered joints, which are difficult to make in silver. (When the second joint is being heated up, to apply the solder, the first joint starts to melt, and when the third joint is being heated, it tends to melt both previous joints, and so on.) It has the registered design number 308820, like the previous ones shown.

B BRASS COLLECTION

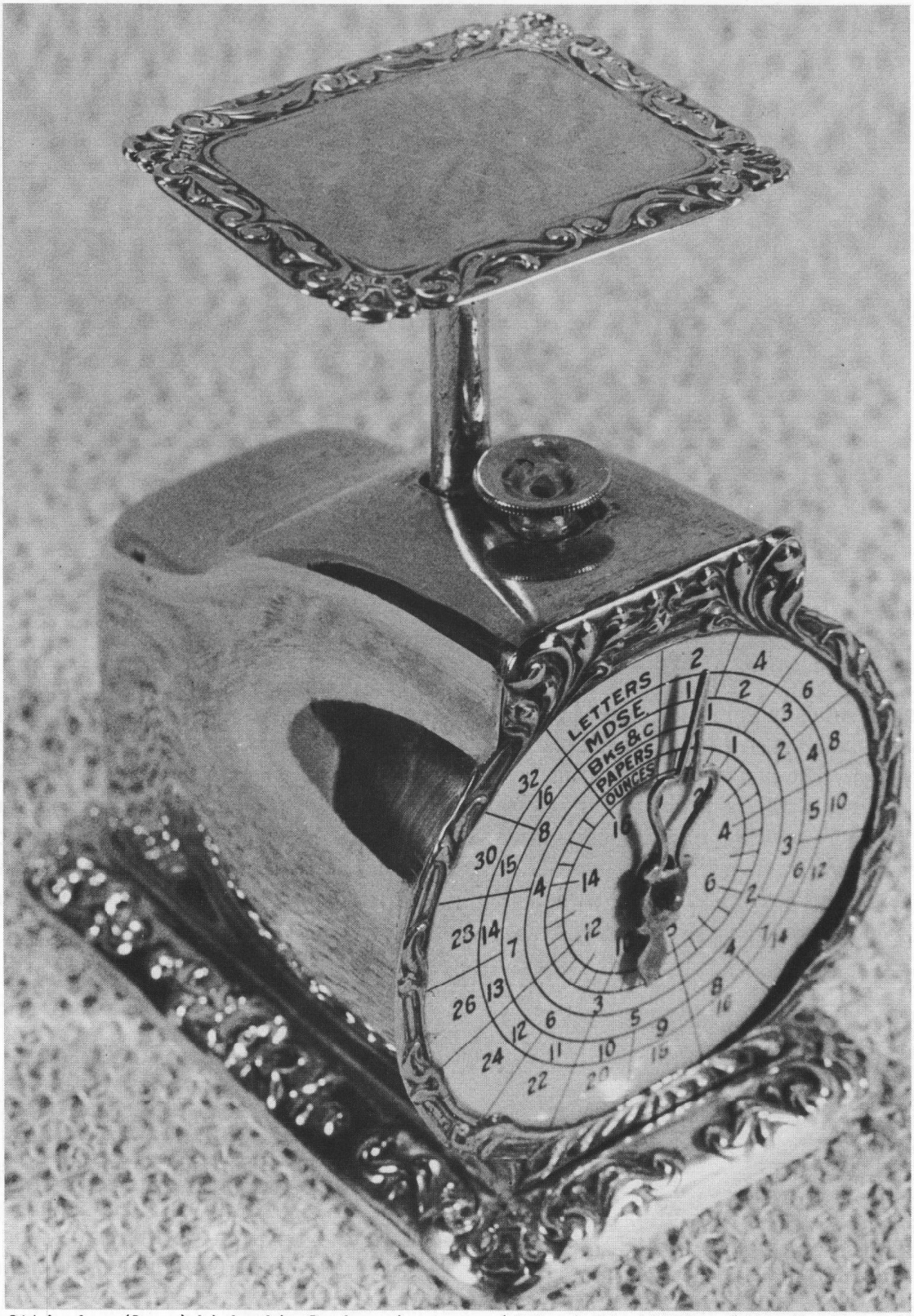
The enchanting ship's pulley on the right is three inches (7 cm) high overall, and is made of rosewood, with a silver face and silver banding, hook and rings. The hook is split, forming a clip into which letters can be slipped. The weight of the letter extends the internal spring and the rack turns the pinion which rotates the pointer. The blued-steel pointer is very vulnerable to damage, being so exposed. No maker's name.

MARGIE STEIN COLLECTION

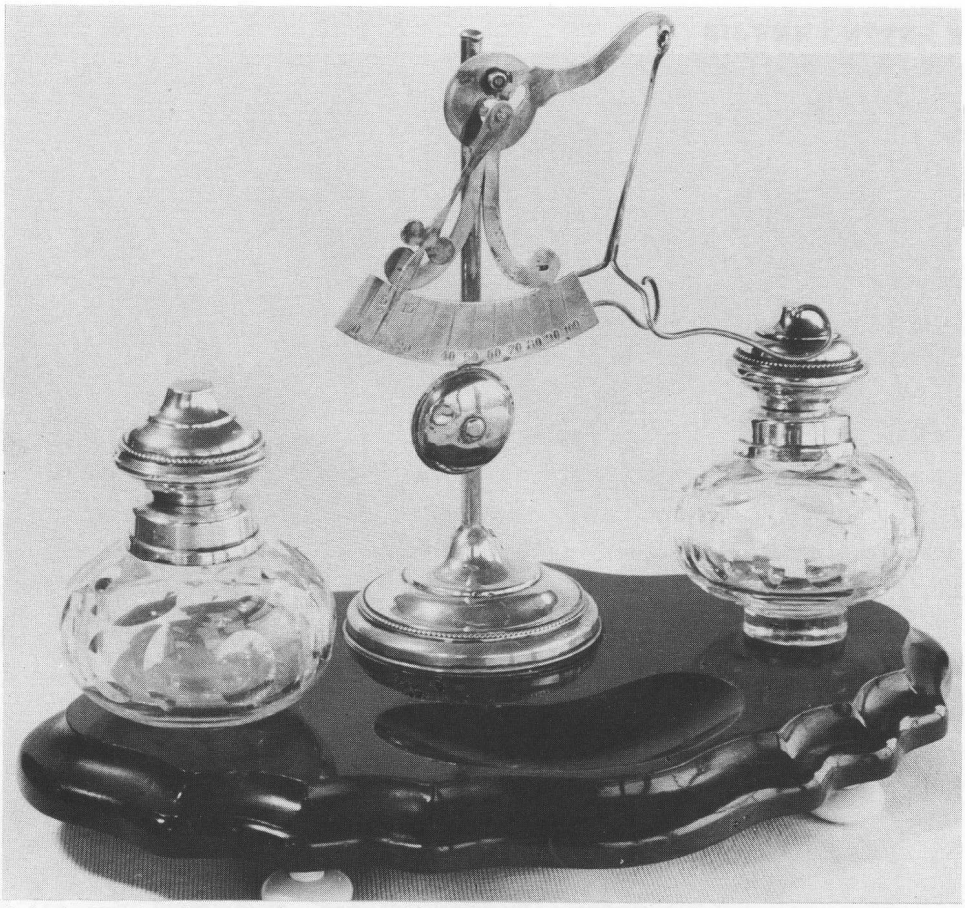




The scale on the left is properly described after the enlarged photograph of it on the next page.

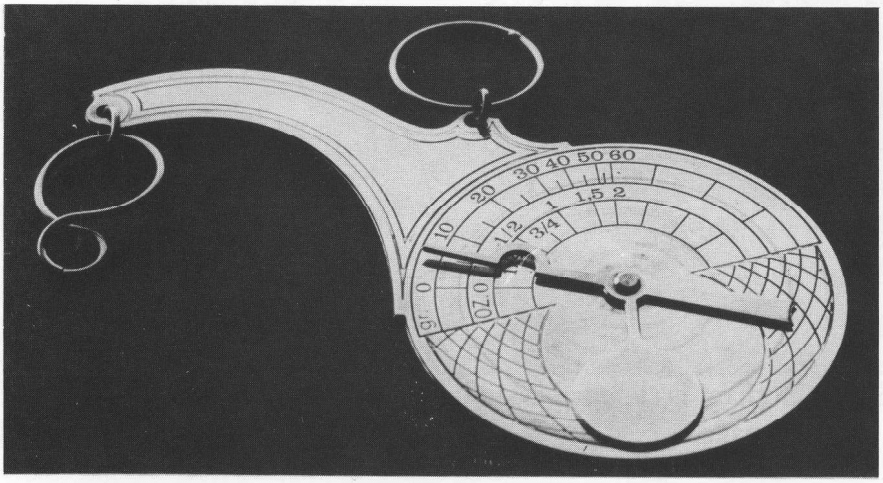


Only 3¼ inches (8 cm) high, this Gorham is stamped 'March 21 1901' and 'G. Sterling. B 398.' Another view of it is on the previous page. B STEIN COLLECTION



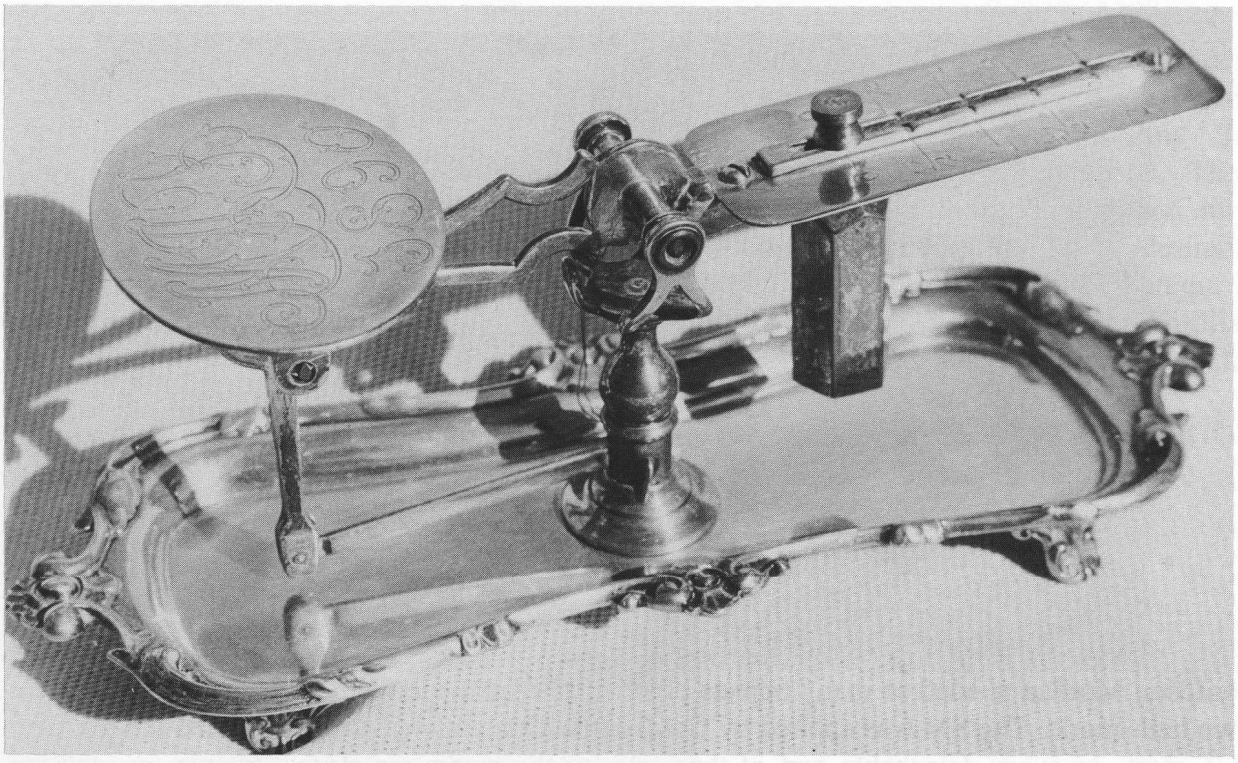
Narcissé Briais in Paris also made a few silver scales. This handsome desk set has ink–wells for red and black ink (red for debts and black for credits,) and a letter scale set on an ebony base with ivory feet. The hanger has been bent, so that the horns are horizontal instead of vertical, but a few minutes work would correct that. There is a curved slot in the disc at the top because the pendulum is pivotted above the pointer's fixing point. This allows the pendulum to hang vertically even when the base is on an uneven surface. This is Briais' solution to the same problem that Ph. J. Maul solved with his Fertig design, (see EQM page 1655.) The graduations of 7½ and 15 grammes were needed for postage rates between 1827 and 1862 only.

F SCHMERL and L UIT DEN BOOGAARD COLLECTIONS



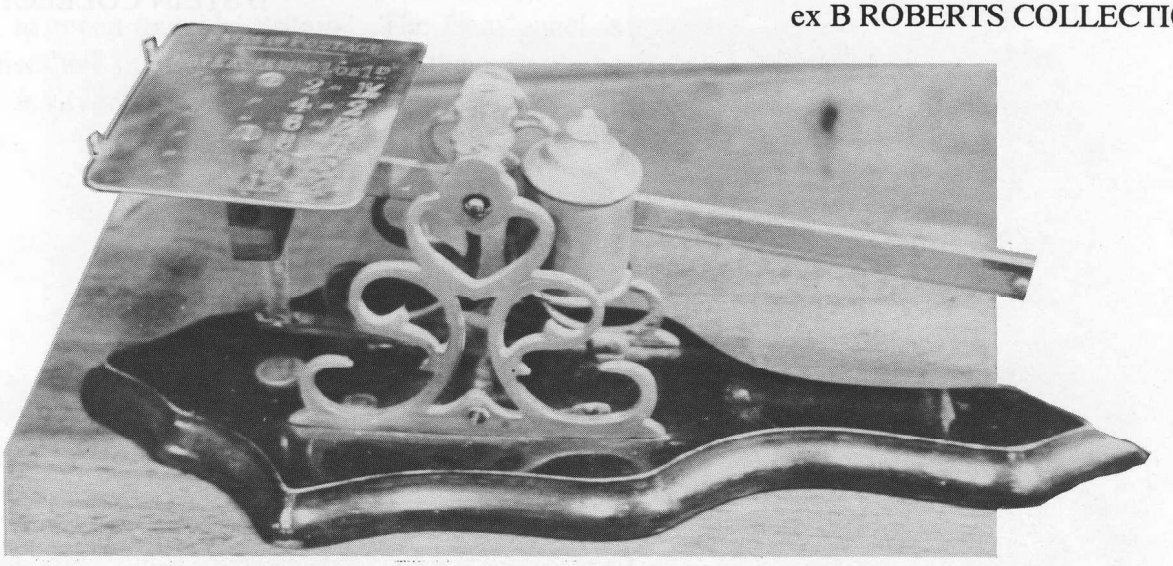
A modern postal pendulum from Paris, made by Christofle in 1976 and sold by Aspreys of London.

CRAWFORTH COLLECTION



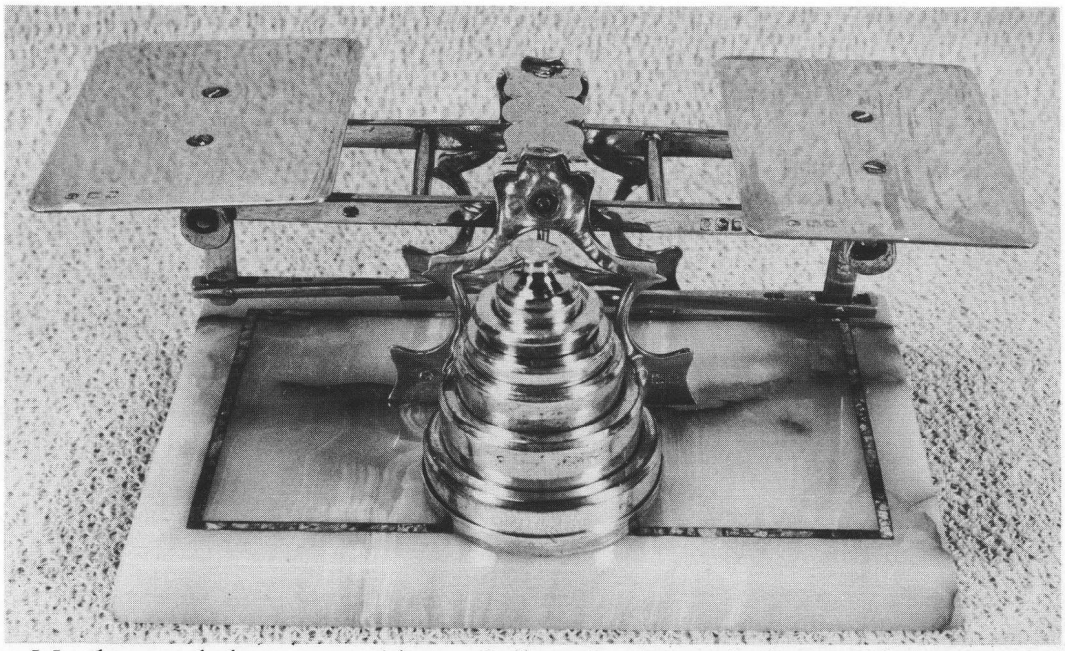
Narcissé Briais of Paris produced a great variety of small scales, including this half-roberval and steelyard, for the British. The letter plate is monogrammed and dated 1890, but the design was patented in 1864, by Victor Briais, French patent number 64178. (See patent drawings on EQM page 1403.) This design of tray was normally used to hold a pair of candle-snuffers (like scissors with a small box mounted on one blade, to catch the charred wick when it was snipped off.) Again, the manufacturer was "mixing and matching" to get variety economically.

ex B ROBERTS COLLECTION



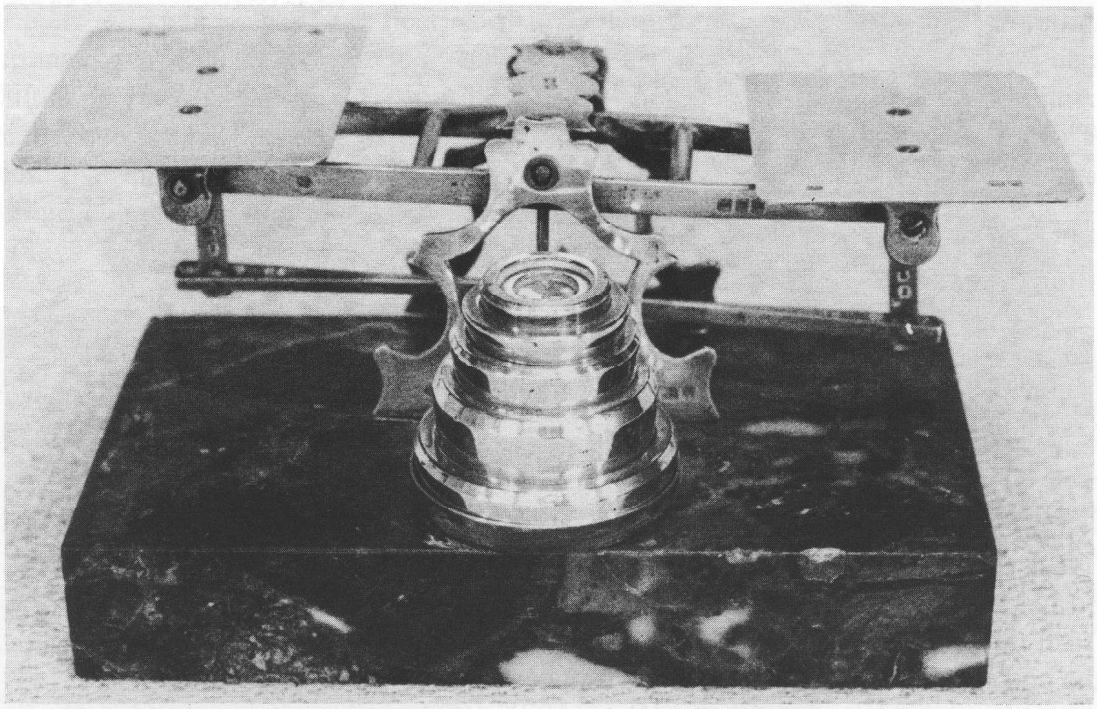
Briais' great rival was S Mordan of London. Mordan too produced a postal half-roberval and steelyard made of silver. The example above was harder to read than Briais', because the user had to read the graduations on the side of the beam. On the other hand, he could then quickly check the postage due by looking at the letter plate, whereas Briais' user had to look elsewhere to find out how much his letter would cost. Rates 1871-1897.

ANTIQUE SHOP



Sampson Mordan needed so many objects of silver that he made them at his factory and had his own hall-mark. The SM was applied by Goldsmiths' Company when they applied the rest of the hall-mark, to every detachable part of the scale, so the marks are clearly visible on each stay, beam, pan and bridge on the lower scale. The upper scale has a beautiful creamy-orange onyx base with black trim, a base that was also used for Mordan's roberval with a bell-shaped A frame, (see page 1680.) The lower scale has a green marble base, like the one on page 1667, again showing the way manufacturers mixed and matched. It has lost the top knobbed weight, a very common loss.

B STEIN COLLECTION

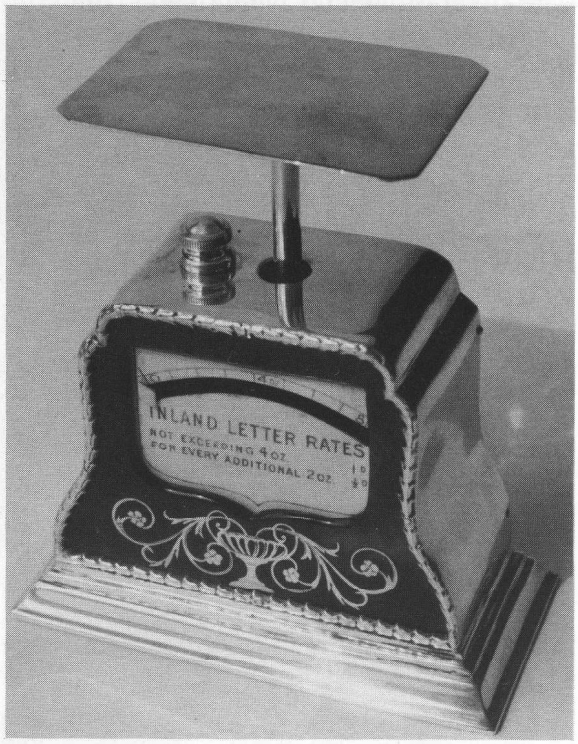


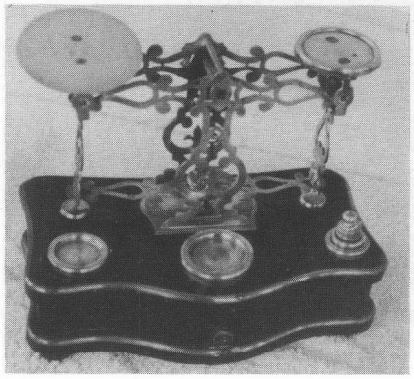
Wilcox Silver Plate Co of Meriden, Conn., were competitors of Gorham and Pelouze, producing another tiny 3¾ inches (9.5 cm) high spring postal. Their products were cheaper, being plated only, but must have looked just as desirable when new. Their patent was taken out in Jan 24 1894, three years after Gilfillan filed his patent for the mechanism for bow-fronts.

B STEIN COLLECTION

The scale on the right was made in Britain, between 1897–1915. 'Inland' was used to mean 'within Britain' and 'overland', 'overseas' or 'foreign' was used to mean 'outside Britain.' The front panel is tortoiseshell inlaid with silver, and the rest of the body is silver.

B BRASS COLLECTION



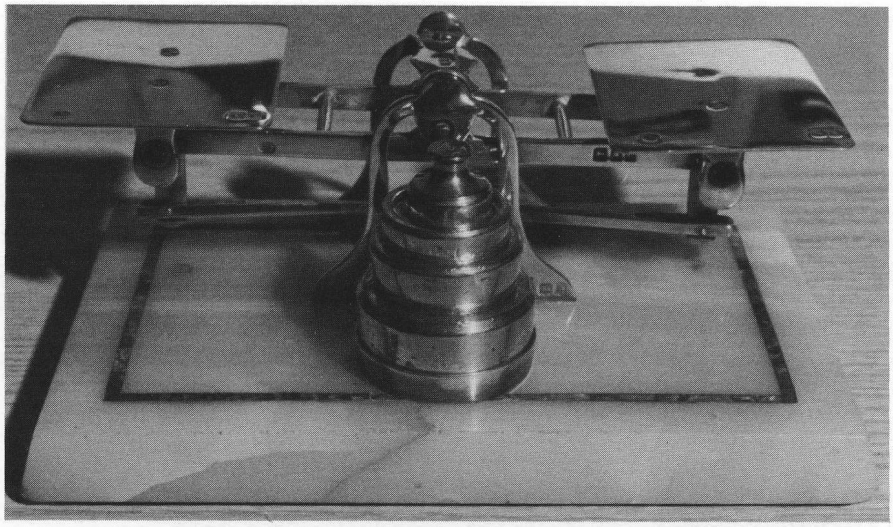


A classic French postal roberval, with its very long vertical stays, on an ebonised drawer, made by NB, (Narcissé Briais.)

ex M WORMSER COLLECTION

The scale on the right has S Mordan's bell-shaped A frame, extensively used on his oval based scales. Compare it with the top photograph on page 1678.

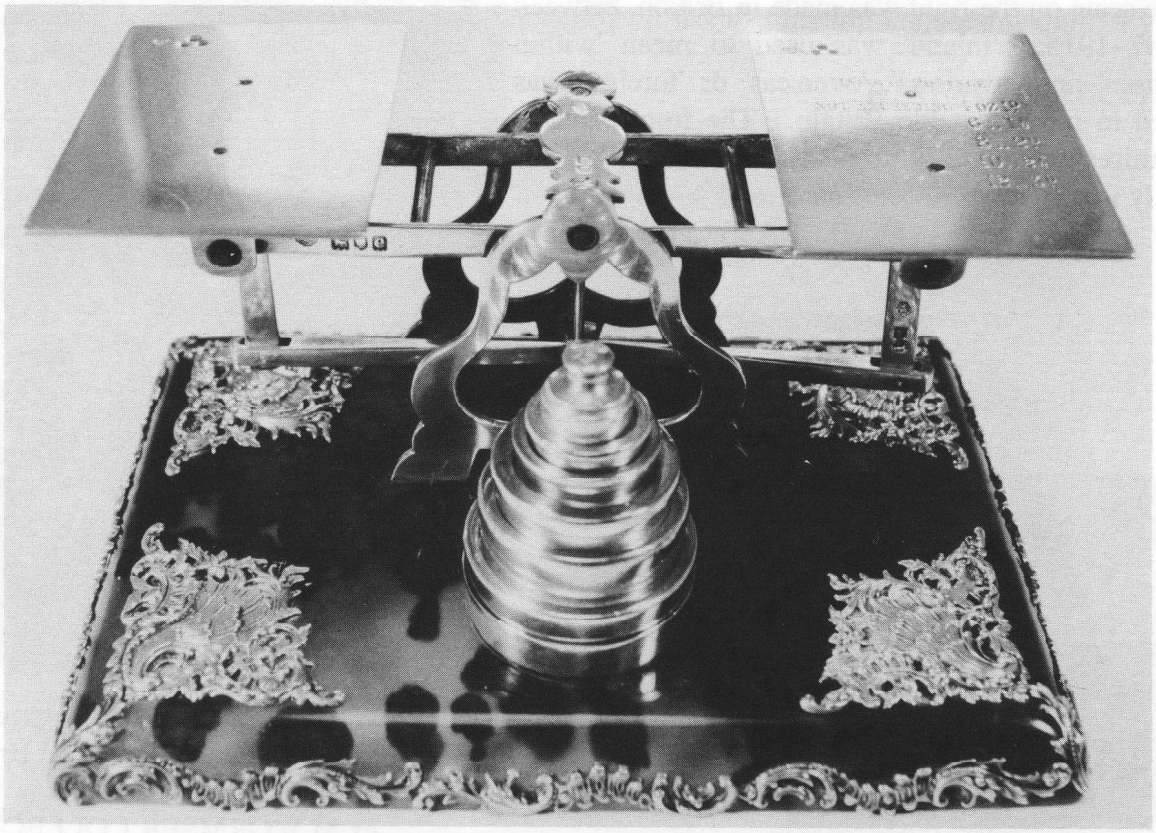
L uit den BOOGAARD COLLECTION

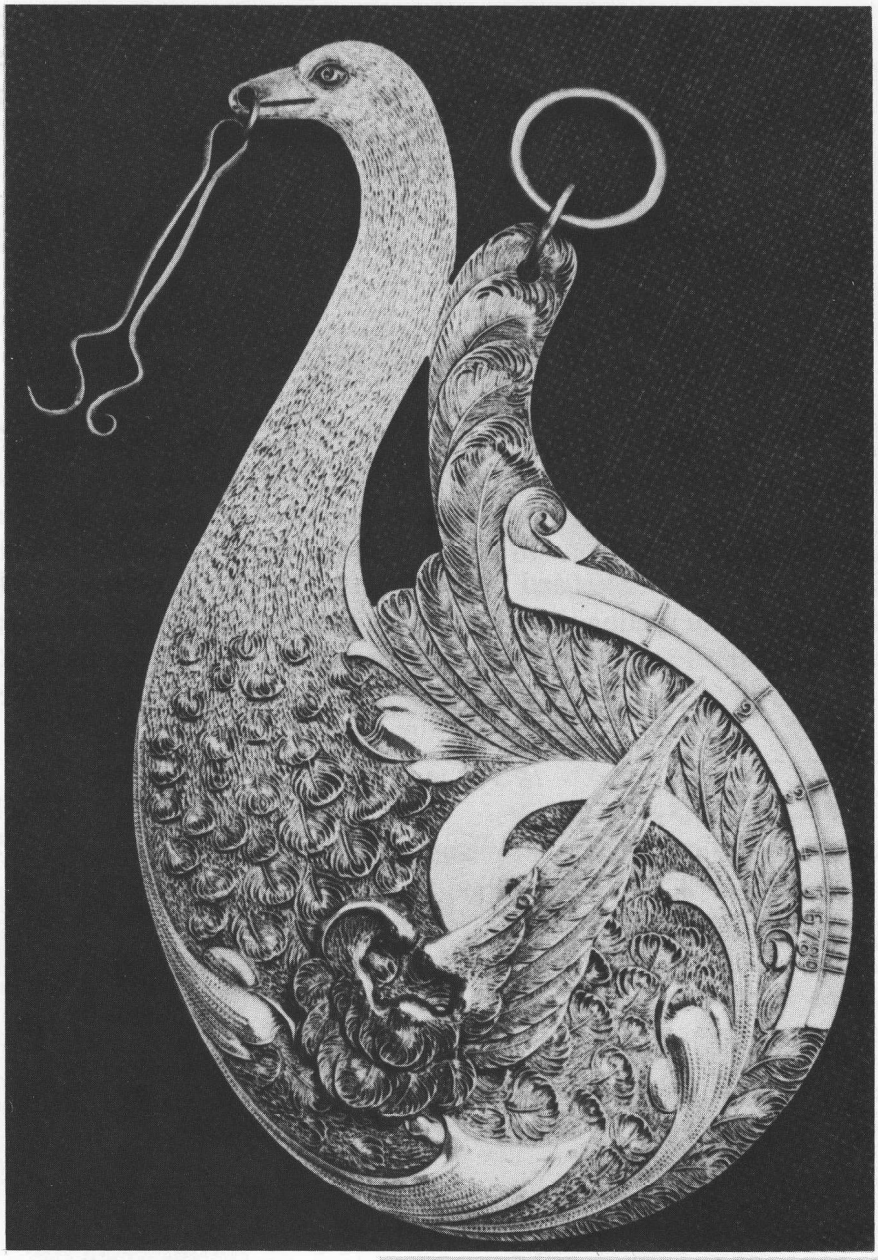


This glorious confection has a rare base, made of domed tortoiseshell without any block underneath it. This allows light to penetrate the tortoiseshell and produce a translucent glow. Made for the postal period 1897-1915, by S Mordan & Co.

The doming was achieved by taking a flat sheet of tortoiseshell, heating it with steam until it was soft and plastic, and trapping it in a former until it was cold. It then held its shape indefinitely. The silver ornaments were rivetted onto the tortoiseshell with silver rivets.

R AXELROOD COLLECTION



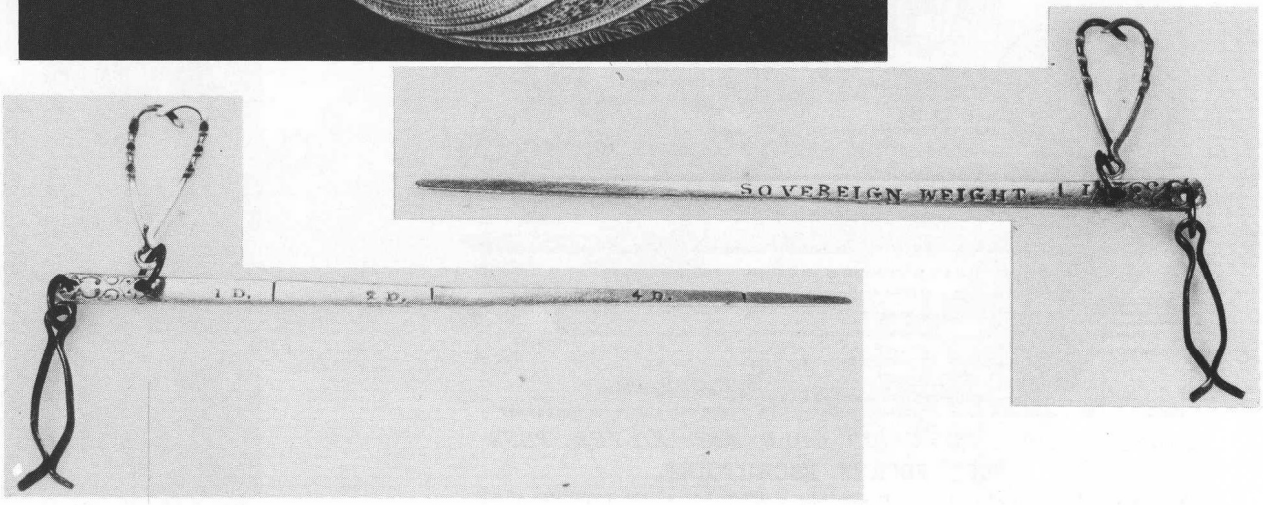


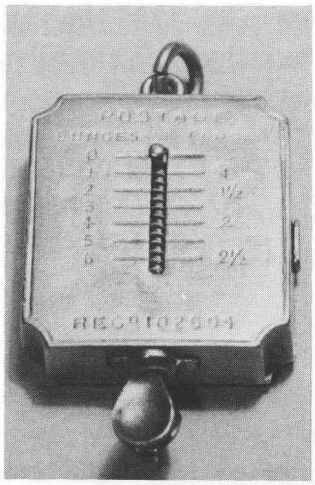
The scale on the left has already been shown on EQM page 1385, but had to be included in any Silver Showcase.

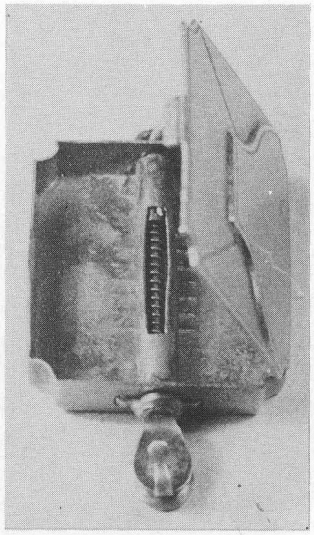
B WRIGHT
COLLECTION

The scale below is a combined letter and coin steelyard. The weight, that moved along the steelyard, had no guard to prevent its falling off, so, naturally, it was lost. It is 3 inches (8 cm) long, and weighs less than ½ oz, so it could legally be sold in Britain without a hall-mark. It was made during the postal period 1840–1871, (½ oz for 1 D.)

CRAWFORTH
COLLECTION







This British silvered brass stamp case has a spring scale inside it. It has Registered design number 102604, which was allocated in 1888 and made before 1897. Maker unknown.

L uit den BOOGAARD COLLECTION

John Sheldon registered many designs in the 1840s and 1850s for pen / pencil / toothpick / half-sovereign gauge / spring scale and seal for sealing wax. This is his simplest design that included a scale, having only the scale to weigh letters and sovereigns and the seal. He used various ornamental cases including German silver (a white brass alloy), brass, silver-plated brass, silver, gold-plating and gold.

1854

JOHN SHELDON,

55, GREAT HAMPTON STREET, BIRMINGHAM,

Manufacturer of Gold, Sterling Silver, & Electro-Plated

EVER-POINTED PENCIL & PEN CASES,

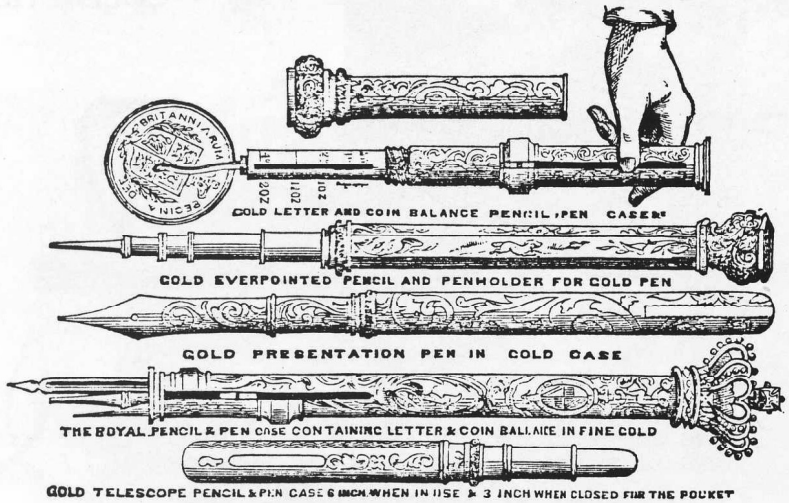
INVENTOR AND SOLE MANUFACTURER OF THE

Letter and Coin Balance Pencil and Pen Cases.

TELESCOPE PENCIL AND PEN CASES,

6 inches when in use, and 3 when closed for the pocket:

FOUNTAIN MUSIC WRITERS, WITH PEN COMPLETE.

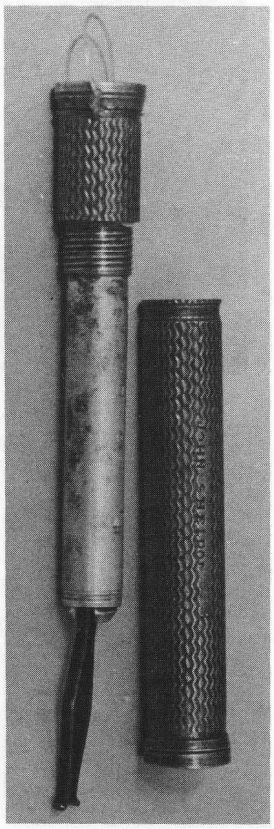


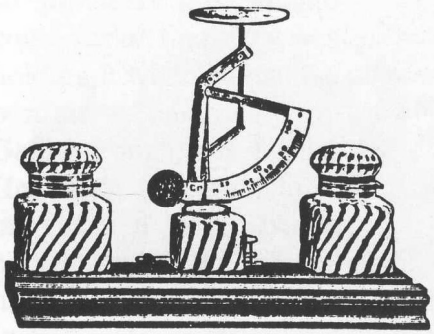
FINE GOLD AND UNION GOLD AND SILVER PENS.

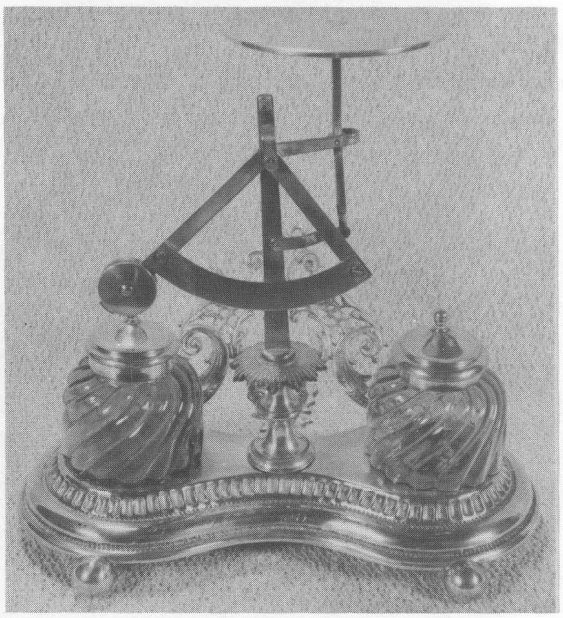
THE POCKET ESCRUTOIRE,

A complete Writing Case, with Letter and Coin Weigher, and all the requisites of the Portable Desk, in 3, 4, 5, and 6 inches long.

CRAWFORTH COLLECTION





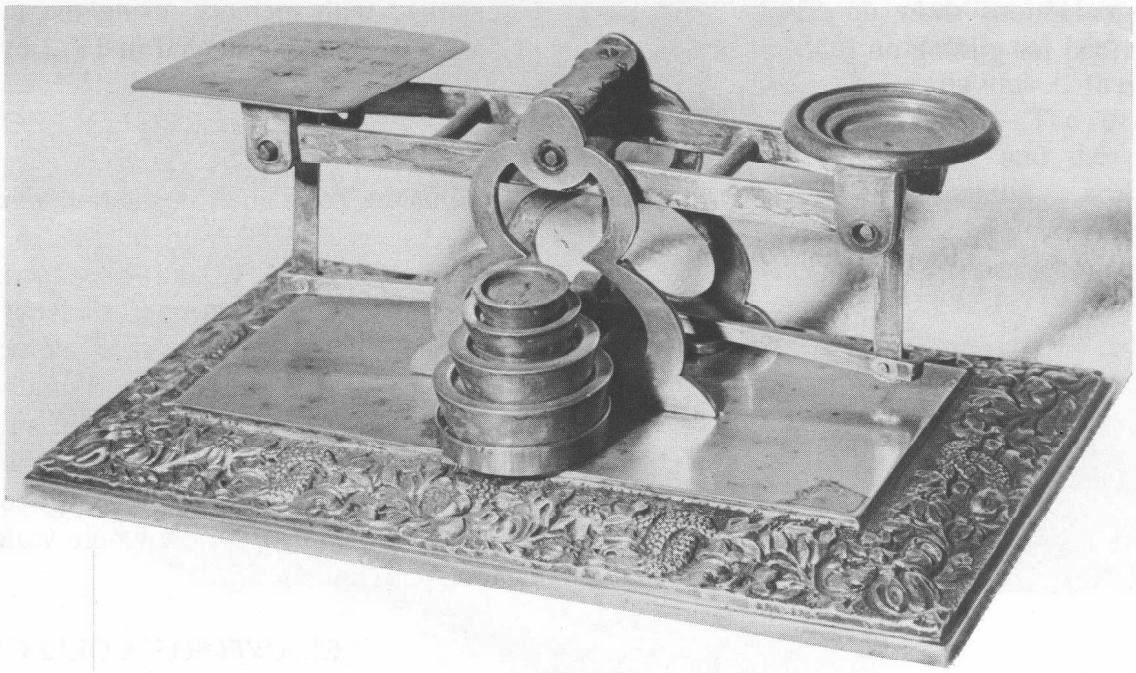


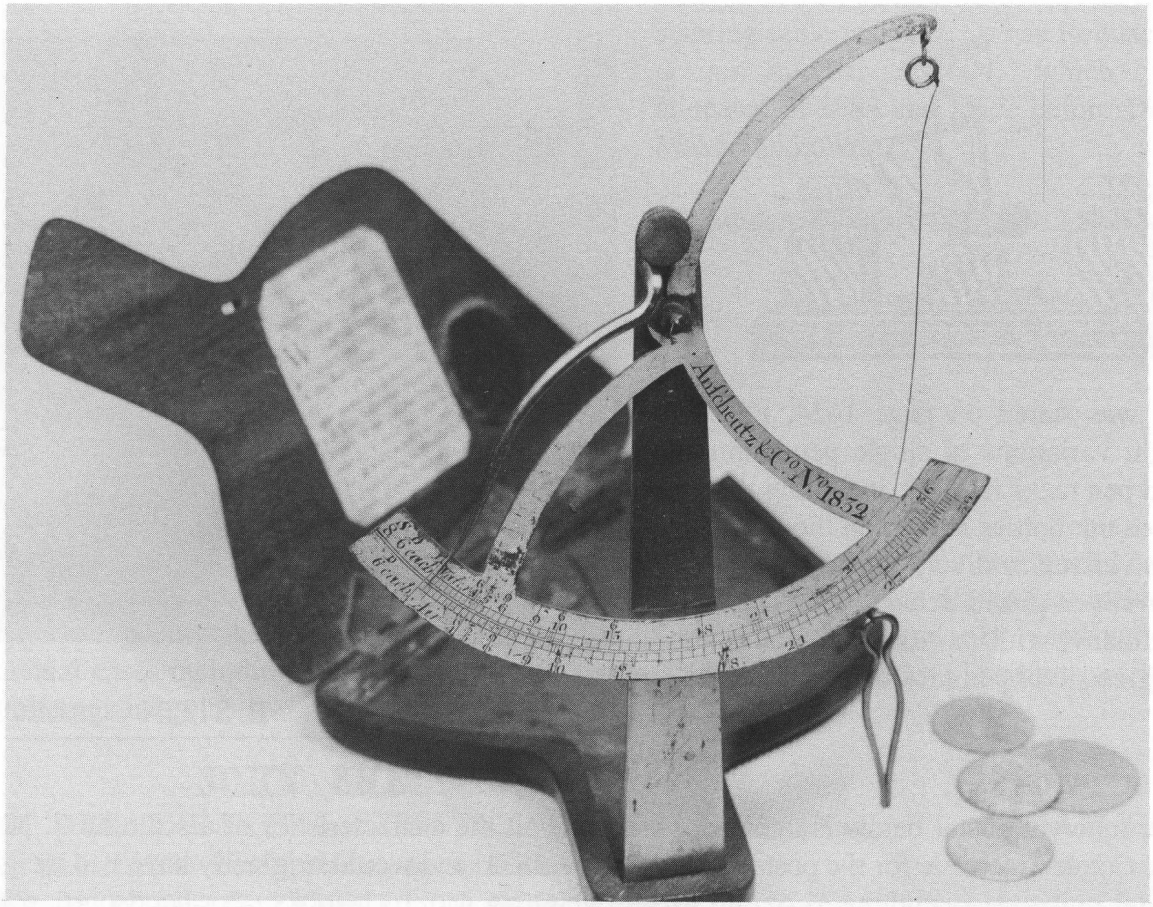
As was stated on page 1654, Ph. J. Maul offered eight variations of single pendulums on ink stands and pen racks in 1909, including the writing set with three ink bottles shown on the left. He did not offer this version in silver, but it bears a great similarity to the silver plated scale on the right, also made in Germany, with its turquoise blue glass bottles, and filigree silver pen rack behind the scale.

B. STEIN COLLECTION

The roberval postal below is unnamed, but bears all the characteristics of a scale by S. Mordan and Co. It was made for the postal period 1840 – 1871, and would originally have had weights in postal units, $\frac{1}{P}$ (weighing ½ oz) up to $\frac{8}{P}$ (weighing 4 oz). It looks very handsome, with the casting showing up nicely under its silver plating.

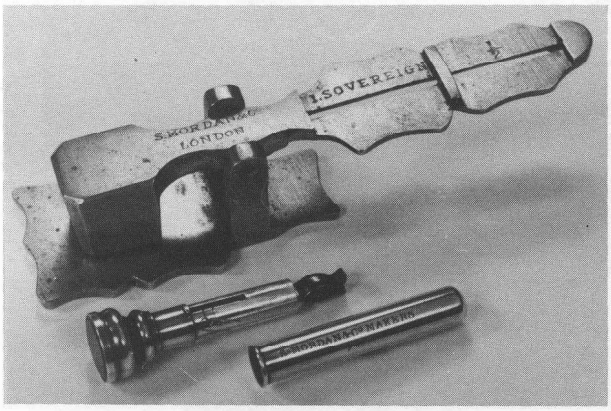
R. WILLARD COLLECTION





All the previous scales have been postals, silvered for ornamental reasons, but Anscheutz and Schlaff silvered their coin scale in the clock–makers' and instrument–makers' tradition, to make the graduations show up crisply. The silver was applied with mercury, using the method described for gilding on EQM page 1580. This pendulum scale was patented in 1772 by J. S. Clais.

CRAWFORTH COLLECTION

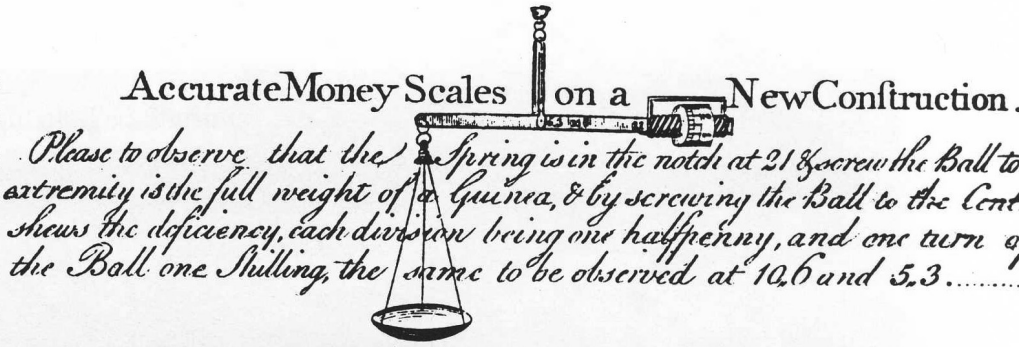


The miniature scale in front of the sovereign rocker was made by S. Mordan and Co. It is marked only ½ and 1, and by experiment, proves to be ½ oz and 1 oz, so it is a letter scale for the period when the first letter rate was for under ½ oz, that is between 1840 and 1871. The object being under ½ Troy oz of silver, it was not hallmarked. The seal in the end is dark green serpentine stone, which looks good with the silver. When capped, the whole scale is 2 inches (5 cm) long.

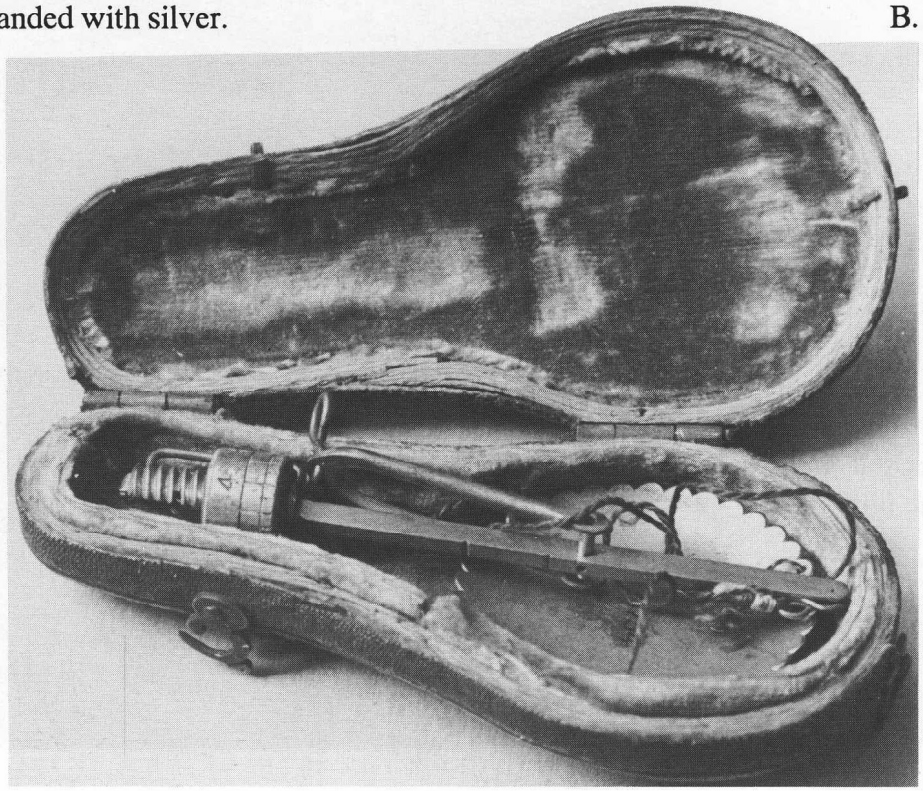
CRAWFORTH COLLECTION

N B. Occasionally sovereign rockers were silver–plated.

John Joseph Merlin was so proud of his minute coin scale that he was holding it when he had his portrait painted by Gainsborough, his friend. He made two versions, one with a silver beam, both to weigh the guinea, half and quarter guinea (worth 21/–, 10/6 and 5/3.) The micrometer was screwed round, after the saddle (on which it rotates) had been clipped into the appropriate notch on the beam. The micrometer then denoted how many pennies worth of gold was lost from the coin. The beam was about 3 inches (7 cm) long. The whole scale slotted into the green, polished shagreen case, which was banded with silver.

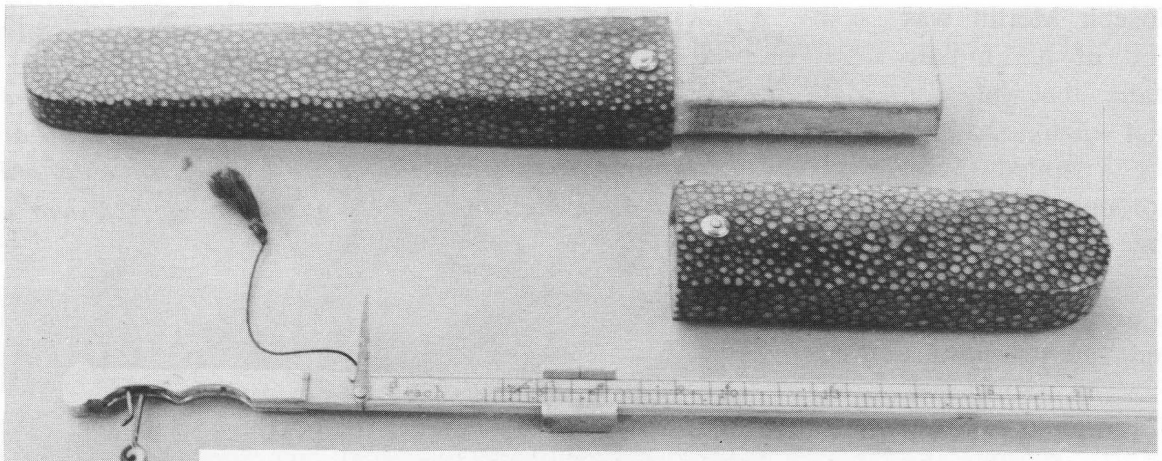


B. BRASS COLLECTION



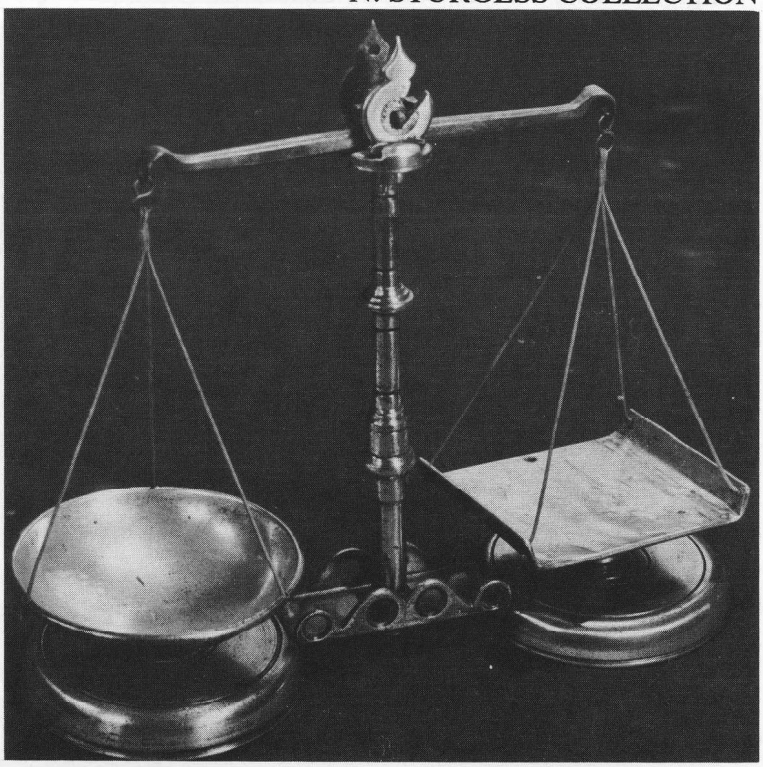
Another Merlin coin scale, to show the variations that he made. The beam is brass, and the pan is elegantly scalloped. The rough knobs on the shagreen have not been polished off. The velvet may have been made in Warrington, where specialists slit the silk loops by running an incredibly sharp pair of scissors along the lines of the loops.

Courtesy LONDON MUSEUM



Ivory steelyard marked "Martin. Fecit . No 3384 ☆". The pointer, which folds down, the coin clip with its two positions and the weight were made of silver. On the side shown in the photograph, the 4/6, 5/3, 6/4, 9/–, 10/6, 13/6, 18/– and the 21/– could be checked. On the other side (used with the clip in the other position) the 27/– and 36/– could be checked. The divisions were worth 6d each. The shagreen case, with the polished surface dyed green, has silver buttons for the user to match up, so that the lid was put on the correct way round. Benjamin Martin advertised in 1772 that he was agent for a 'patent index balance' at his shop at the sign of Hadley's Quadrant and Visual Glasses near Crown Court in Fleet Street, where he sold a multitude of scientific instruments, (one of the first such shops, and certainly the most important, to offer scientific instruments 'off the shelf') and in 1773, he published his 'Monied Man's Vade Mecum..' See pages 299–303 of EQM.

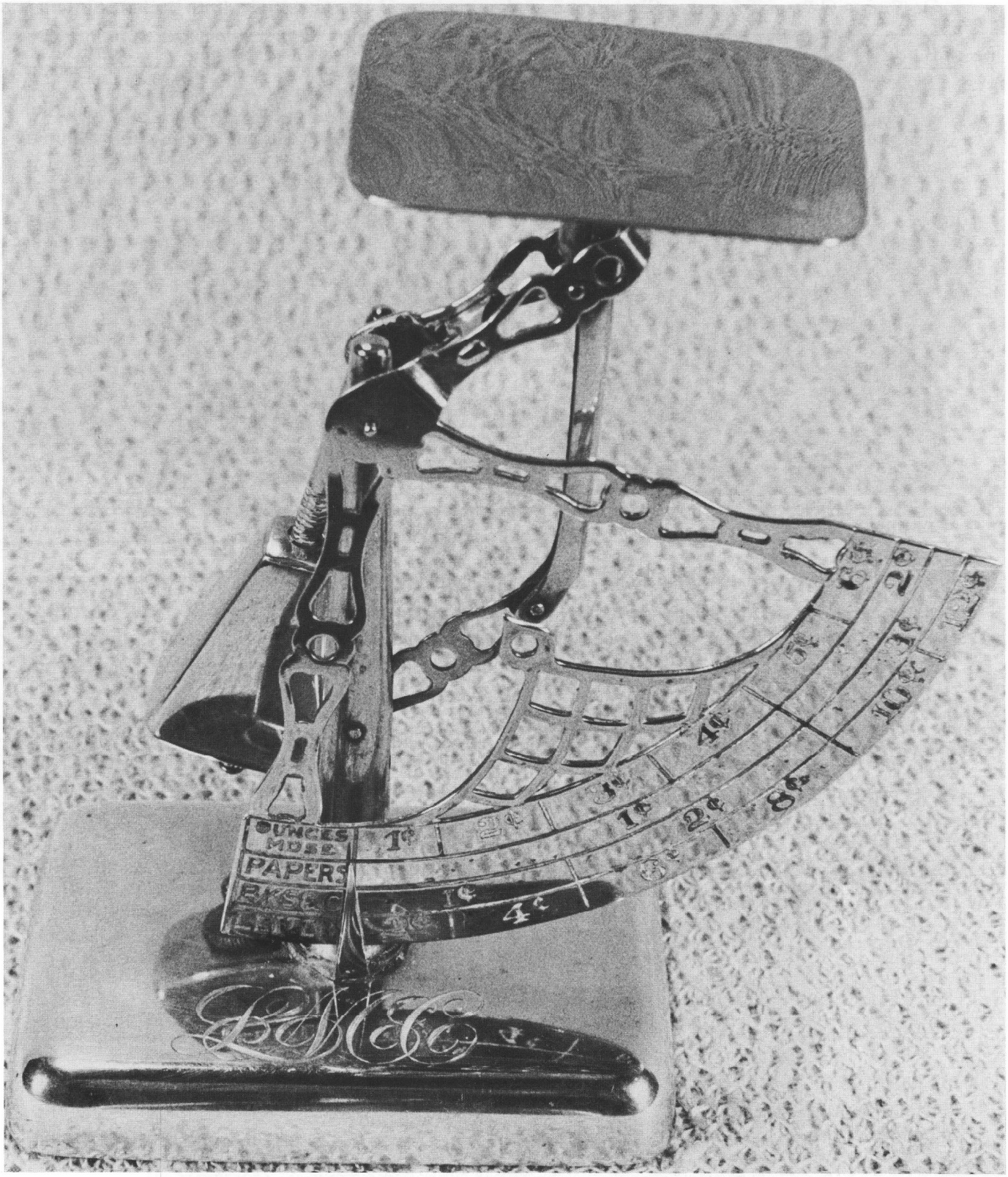
N. STURGESS COLLECTION



The peculiar little scale on the right was bought in London, but it does not look British. It is more reminiscent of a French postal scale, but it would be difficult to push a letter between the flat pan and the top of the cords, as the whole scale is only 6½ inches (16 cm) high. The pans are silver plated, while the stand and pillar are brass. Two knobbed postal weights could fit each side of the pillar, rather inconveniently.

CRAWFORTH COLLECTION

Only 5 inches (12.5 cm) high, marked Sterling B 3501, with Gorham marks.

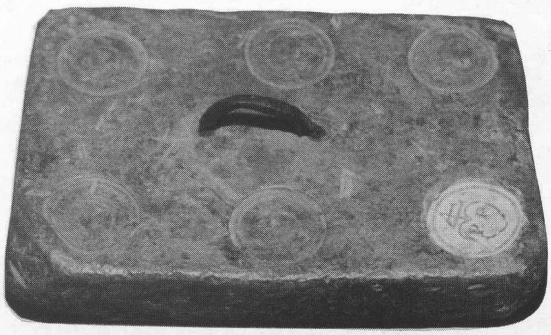


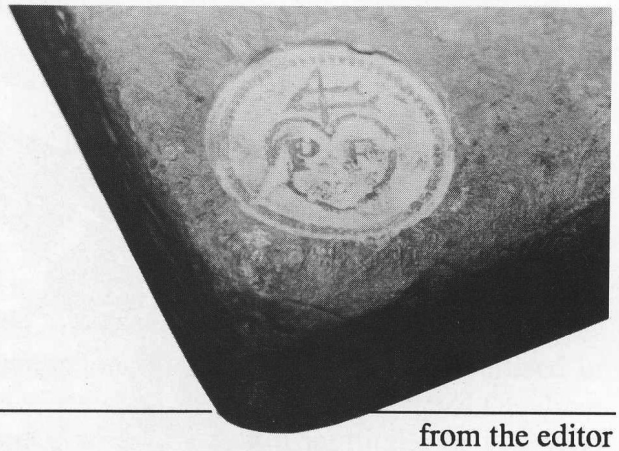
B STEIN COLLECTION

Notes & Queries

NQ. 120 — from R. Rix

In Toulouse, France, I bought a rectangular lead weight (120 x 82 x 22 mm) with an iron handle, weighing approximately 2248g., and having 6 equal marks impressed, each showing PF within a heart, below a modified number 4 (with arrow-like extensions to the right.) The dealer said it was a weight of the British East India Company, but other sources say that it is not a weight but is money.





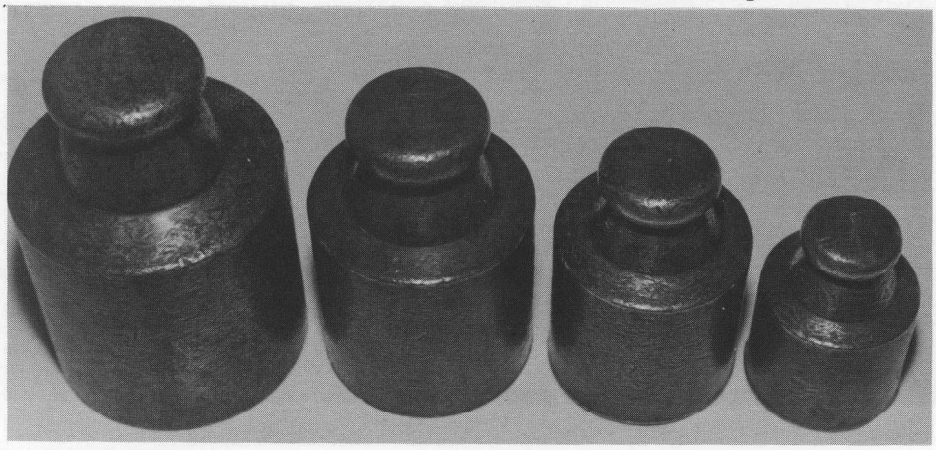
Comment — from the editor

I would be surprised if money was ever made with a ring in the top, and one piece of money weighing 2248 g. (5 lb) seems excessive! However, Donald Gear, in his new book "Earth to Heaven", writes of leads' being used as money in Burma, Laos, North Siam and Yunnan, and shows a bun-shaped lead ingot, used to buy household necessities. The quantities of lead were huge, and so we cannot dismiss the idea of your "weight" being money.

The mark of the British East India Company was a heart with EIC in it, not PF.

NQ. 121 — from R. Rix

In Quebec, Canada, I bought a set of 6 brass cylindrical knobbed weights, for 5, 3, 2 and 1 [lb],



and 8 and 4 [oz]. The neck of the weights is exceptionally thick and straight. The 5 lb weight has 8 and crowned VR, and crowned VR and 4 on it. VR will mean Victoria Regina, but I have no information on the letters D and C, or the numbers 8 and 4. (Province? Town? District?) Can any member help?

NQ. 122 from R. Rix

When I was in London I bought a flat, square and conical brass weight, with the upper surface (15 mm x 15 mm) larger than the bottom surface. It is marked 144 lb 1, and weighs 3.16 g.

Comment from the editor

This would seem to be an estimating weight. I think it was for a product that was sold by the gross (that is, sold in batches of 144). So, to use your weight with the rest of the weights in the set, the user would put one of the objects to be sold in one pan of a small scale and balance it against your weights. It might, perhaps, weight 37. That would mean that 144 of the objects would weigh 37 lbs. The user would go to his large scales, put 37 lbs on the weight pan, and pour objects into the load pan until it balanced. A very quick way to measure out 144 objects without counting!

NQ. 123 from R. Rix

I also bought two other weights of the same shape as the one above.
One is 16 x 16 mm, stamped with a crown and 7, and weighs 6.59 g.
One is 17 x 17 mm, stamped 14, and weights 13.17 g.

Comment from the editor

I have weights labelled 7 and 14 of the same shape and approximately the same mass. Mine are gilded, and have the additional stamp of 480, lb. They are for finding out how much 480 sheets of any one thickness of paper will weigh. They were used within the paper trade to identify the thickness (that is, the weight) of the paper being handled. The thickness was rated in pounds (lb) for a ream of paper. A ream was a standard pack of paper sold by paper mills, and, unfortunately,

four different reams were in use – of 480, 500, 504 and 516 sheets. This nasty situation arose historically, because some mills gave an allowance for wastage, that is, for ruined sheets of paper.

So, let us pretend that we want to buy some paper. We have a sheet of the quality we want, but we don't know what it is called. We take a whole sheet, not cut or diminished, and we roll it up, putting it on the equal-arm scale. Ours is a demy sized sheet, that is, it measures 17½ by 22½ inches. By using the various paper weights (which are for 1, 2, 4, 7, 14, 28, 56 and 112 units) we balance it at 24 units (this was done using my 80 g. copying paper.) That signifies that a ream of 480 sheets of copying paper would weigh 24 lb. Now we should be able to order more copying paper from the mill or the wholesaler.

Vandome & Hart, about 1935.

PAPER MAKERS SCALES

No. 85. For ascertaining ream weights of 480, 500, 504 and 516 sheets of any size paper by weighing one full size sheet.

Best quality brass boxend beam, solid brass pillar, brass chains and concave pans and fitted with special hanger

Mounted on Mahogany box with weights fitted in drawer.

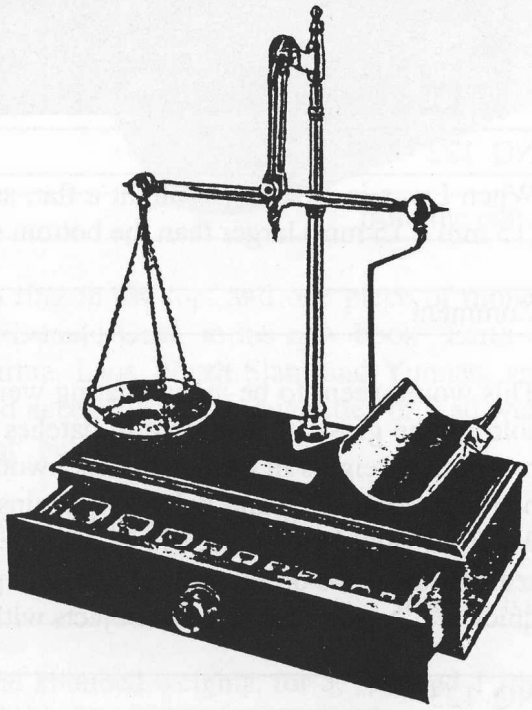
To weigh— 200 lb. × ½ lb. per ream.

Price—with 1 set of weights 125/-
" 2 " " 150/-
" 3 " " 175/-
" 4 " " 200/-

No. 330. Brass weights for above.

Size 112 lb. to ½ lb.

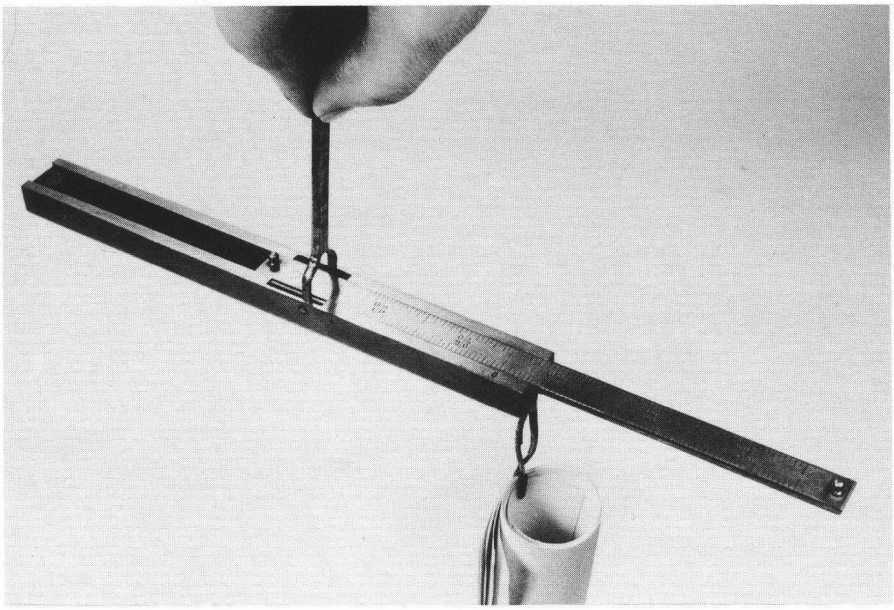
Price per set 24/-



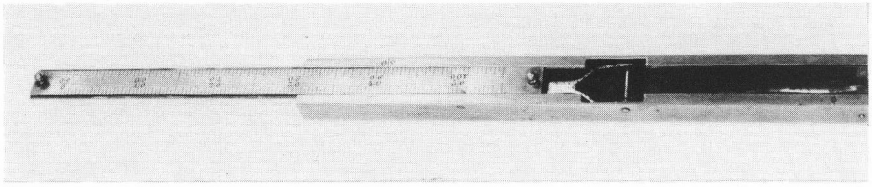
No. 85.

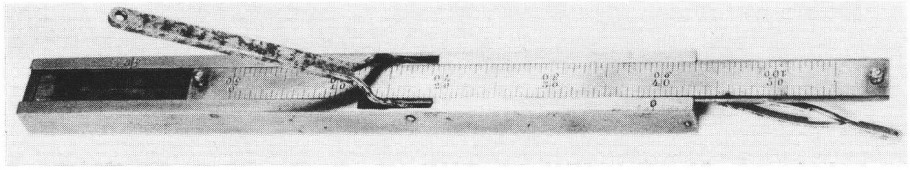
VANDOME & HART LTD

I checked this answer using another of my paper scales, a small brass steelyard. I clipped the same roll onto the steelyard and it balanced at 25, so I presume that it was reading 25 lb for a ream of 480 sheets. My problems with the steelyard were that (a) it had no lb sign on it and (b) it does not specify which ream it is reading off in.



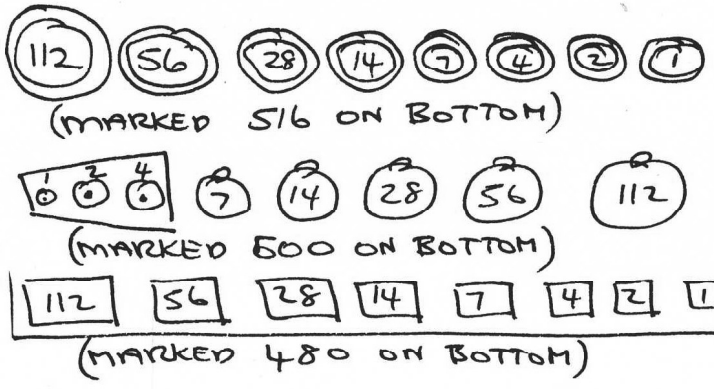
The steelyard weight (which is also its lid) slides right across the middle. For thinner papers, the user pushes the weight to the right and reads off against the zero on the front edge of the box, while for thicker papers, the user pushes the lid to the left (as viewed in the top photograph) and reads off against the zero on the rear, left end of the box.

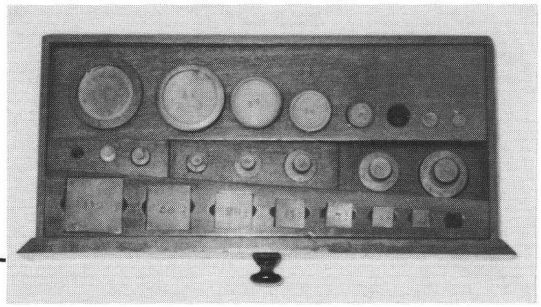




NQ. 124 from R. & E. Park

We have an equal arm scale on a pillar, mounted on a two drawer chest, made by DeGrave & Co., London. The pan on the left is circular, but the plate on the right is flat. In the top drawer are three sets of weights. The rear set is round with a circle indented round the numbers and marked 516 on the bottom. The middle set is flat and cylindrical with a knob on top, marked 500 on the bottom. The front set are square and marked 480 on the bottom. Sketched below.



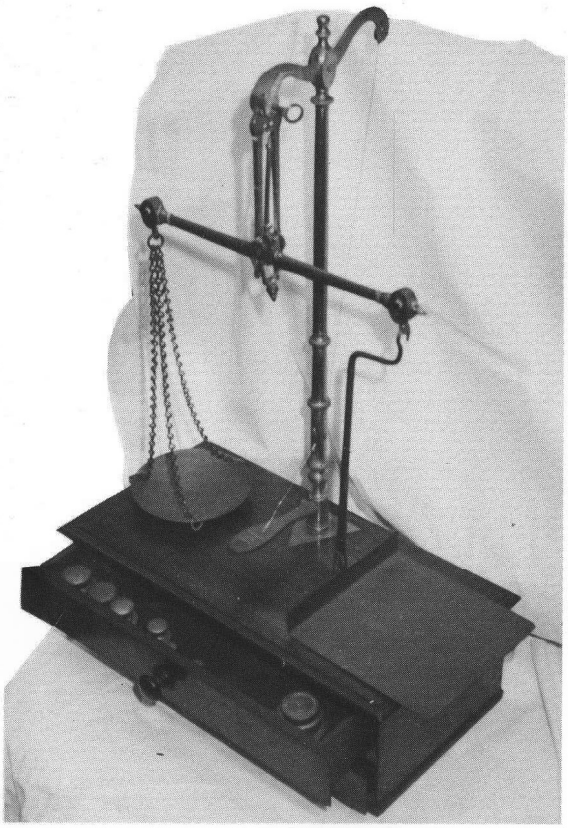


Comment from the editor

The numbers on the top of the weights reflect the traditional multiples used for avoirdupois pounds. By using different combinations, the user can obtain any and all numbers up to 224 (just as one can with the decimal system of 100, 50, 20, 20, 10, 5, 2, 2, 1.)

The clues to the use of the scale comes from the flat pan on the right, and from the 516, 500 and 480 marked on the bottom of the weights. As you will have gathered from the answer to NQ 123, you have a very nice paper scale. I cannot find out exactly when reams were finally dispensed with by the paper trade, but it was well within living memory. One paper mill in Somerset still sells by the ream, even though they weigh the paper in grams per metre and convert back!!

DeGrave and Co. was only one of several companies selling paper scales with their own name on them. Not all the companies *made* the scales.



SOME PAPER SCALES "MAKERS"

Maker or Retailer	**Town**	**Type of scale**
W & T Avery	Birmingham	Counter steelyard
W & T Avery Ltd	Birmingham	Counter steelyard
J. Casartelli	Manchester	L. Schopper's pendulums
DeGrave & Co	London	Equal arm on pillar
L. Exupere	Paris	Steelyard
Fairbanks & Co	St Johnsbury	Wall mounted steelyard
Fairbanks, Morse & Co	St Johnsbury	Steelyard in case, on pillar or bracket
G. Kern & Sohn	Ebingen	Pendulum
F. Leunig & Co	London	L. Schopper's pendulums
A. H. Mardon	London	L. Schopper's pendulums
Ph. J. Maul	Hamburg	Pendulum
H. E. Messmer	London	L. Schopper's pendulums
B. Nedden & Co	London	Pendulum
Geo. Salter & Co	West Bromwich	Spring
L. Schopper	Leipzig	Pendulum
Sindall	?	Pendulum
Vandome & Hart Ltd	London	Pendulum, and equal arm on pillar
Vandome, Titford & Co Ltd	London	Pendulum

More about paper scales in the next issue of Equilibrium.

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EQUILIBRIUM®

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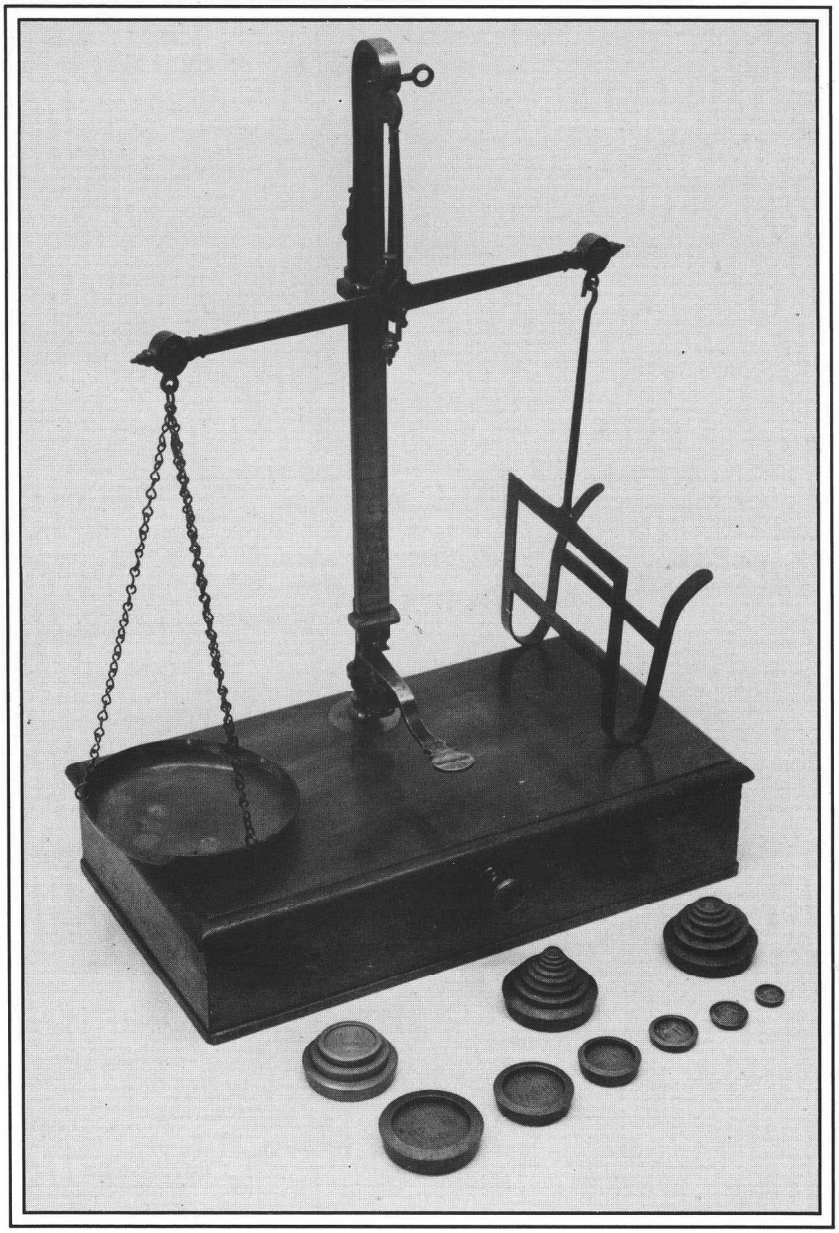
1993—ISSUE NO. 3

PAGES 1693-1720



Cover Picture

After the query about paper scales on page 1689, I promised to continue with an article on paper scales. After the peculiarities of the little brass box, and the classical elegance of the DeGrave & Co, it is difficult to find exciting ones to show you, but the one on the cover is an exceptionally nice scale, with a special holder for the rolled sheet of paper. The top of the pillar is fourteen inches from the table, and the mahogany drawer is eleven inches wide. The brass beam is stamped Avery, and the lever is stamped W & T Avery.

The whole scale can be dismantled and stored in the box, by taking the hanger off, removing the pan and chains, unpinning the beam and unscrewing the pillar. Many English scales of this size could be stored in their boxes, but they were usually for apothecaries' use, (and had a glass pan which would not be corroded by the chemicals,) or were for weighing bullion (and had troy weights.)

This scale can only be identified as a paper scale because of its weights. There are three stacks of brass weights, which are stamped with the number of sheets in the ream, and with the estimated weight that that number of sheets would weigh. Thus, in the set marked 480, there are weights stamped 4 lb., 7 lb., 14 lb., 28 lb., 56 lb., and 112 lb. Similarly, there are weights stamped 500 and 4 lb., 7 lb., 14 lb., 28 lb., 56 lb. and 112 lb. The 516 set starts at ½ lb., 1 lb., 2 lb., 3 lb., 4 lb., 7 lb., 14 lb., 28 lb., 56 lb. and 112 lb. This last set is probably complete, and represents the Avoirdupois increments as traditionally used in Britain.

The extra set of weights is made of white metal and is marked 510 and 25 lb., 50 lb., and 100 lb. These are decimal increments, which came into use gradually during the end of the nineteenth century and the beginning of the twentieth century.

Came from the Cowan Paper Mill in Penicuik in 1975. Owned by the National Museum of Scotland, reference number T. 1993, 84. Photograph by Michael Crawforth.

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Paper Scales

By D F CRAWFORTH-HITCHINS

Paper was originally made by mashing rags, suspending the sludge in water and then sweeping a flat sieve through the sludge to catch a thin layer of the wisps of rag. The damp layer dried slowly into paper, and the thickness was only as consistent as the paper-maker was consistent in his sweep through the sludge. The size of the paper was dictated by the size of the sieve, and the common size of the Demy sheet, about 18 x 22 inches, (45 x 55 cms) was dictated by the strength needed to pull the sieve through the sludge while a layer was accumulating on it. Before 1780 there were only eleven types of paper classified, but, by 1793 there were seventy three types of paper. Paper production changed dramatically when mechanisation was developed during the early part of the 19th century, and it became easier to produce subtle variations that could be consistently differentiated.

The necessity to be able to differentiate papers was very important because of a tax brought in during the tenth year of Queen Anne's reign, (1711,) which caused all paper mills to pay a tax on all the paper they produced. The amount of tax depended on which type of paper was being assessed, and, if there was any doubt as to which it was, the assumption was that it was of the higher quality. The paper was weighed, and the tax was paid on the weight of each type of paper made at that mill. The Exchequer benefited considerably from this tax. In 1738 it gained £155,000 from the tax on beer and ale, and it gained £89,110 from the tax on paper, so the paper mills wanted to be sure that the excise men used accurate scales! The law was not repealed until 1861.

Fig. 1 SOME NAMES OF PAPERS

Drawing Papers	**Cartridge Papers**	**Printing Papers**
Emperor	Engineering	Double Large Post
Antiquarian	Double Crown	Sheet and half Post
Double Imperial	Ammunition	Music Demy
Double Emperor	Cartridge	
Atlas		**Brown, Sugar, etc.**
Colombier	**Blotting Paper**	Casing
Super Royal	Royal Treasury	Double Nic-a-Nee
Demy		Double 4 Pound
Foolscap	**Miscellaneous Papers**	Bag Cap
	Royal Drying	Kent Cap
Account Book & Writing Papers	Tissue Double Crown	Havon Cap
Medium Foreign Post	Filtering Paper	Plutarch
Pinched Post	Copying Double Foolscap	Saddleback
Pott	Long Elephant	Double Small Hands

Each paper name (see Fig. 1) was of a size of paper, which was sold with variations of that size. If the trader needed 30 x 23 inch brown paper, he ordered Imperial, but if he wanted bigger paper, he might order Double Imperial, 45 x 29 inches. This was complicated by the small variations available within a size, as Imperial could be 30 x 23, 29 x 22½, or 29 x 22 inches, so he had to specify which Imperial he needed! Double Small Hands came in seven slight variations of size! The largest paper sold by A H Mardon was Emperor drawing paper 72 x 48 inches, which weighed 620 to 660 lb. for the ream and must have been carted in unwieldy rolls. In Holland, very similar names were used for their paper sizes, as shown in the chart on page 1360 of Meten & Wegen.

Not only was the size varied, but the substance varied too. As long as the paper was within 5% of the weight specified in the order, the customer could not reject it. So one batch, ordered at 100 lb. a ream, might weigh 95 lb., and the next order might weigh 105 lb., which was a difference easily felt and very noticeable!

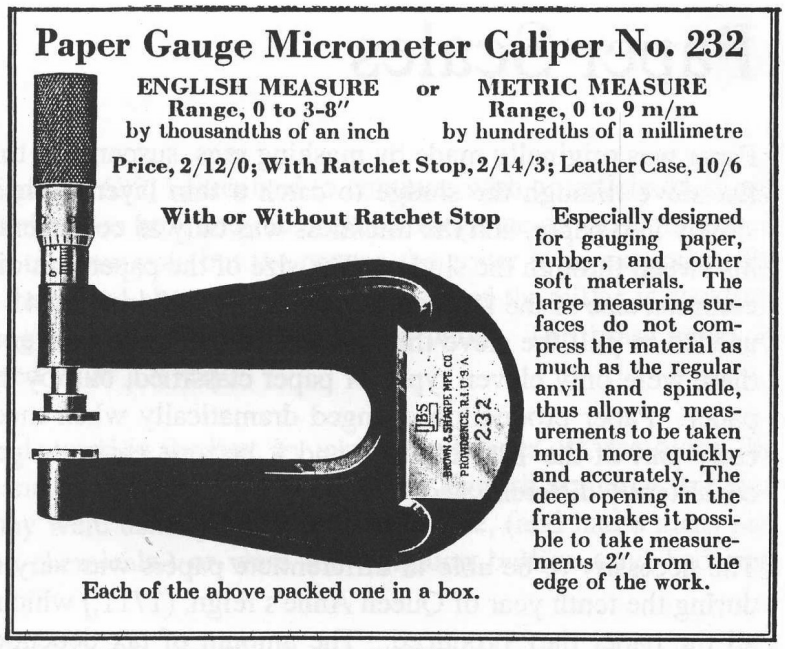


Fig. 2 Brown & Sharpe Mfg Co, U S A, 1927. For export to Britain.

Paper scales were used by Government departments, newspaper printers, railway companies, paper mills, stationers, and large companies during the 19th century. These customers needed paper for different purposes, with one quality being a predominant need. An office needed paper that accepted ink but did not spread it to a blur, a grocers' shop needed paper that did not burst when damp, ammunition makers needed tough paper that did not split or crush when compressed and tissue paper users needed it to be thin but crisp. There were special instruments to test each of these qualities (see Fig. 2), amongst which were the scales to test the substance of the paper. The large number of companies offering paper scales imply that many people needed paper scales. These were people who had no record of what paper they had ordered previously, or wanted to change paper types, and were working from a small sample of what they wanted.

Some scales' sellers offered to supply the paper scale with special graduations. They could be graduated with English reams, Swedish weights or with Kilograms, the weight used in any other country, with a combination of reams and kilos or with the equivalent weight per ream of paper in reels, (see Fig. 14.)

In Britain, reams were used as the number of sheets in a bundle before 1411, when all paper was imported from Europe. Paper was first made in Britain in about 1480, and by 1616 a British ream was defined as 500 sheets. By 1754 a British ream could be 480 or 500 sheets.

By the nineteenth century, during which surviving paper scales were made and can provide evidence, reams came in 472 sheets (for hand-made or drawing paper), 480 sheets (an inside or regulation ream,) 500 sheets (a standard ream for newspaper or book paper,) 504 sheets (a stationers' ream,) 510 sheets, 516 sheets (a printers' or perfect ream for book paper,) and 520 sheets. The Americans also used one of 400 sheets.

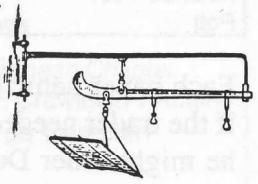
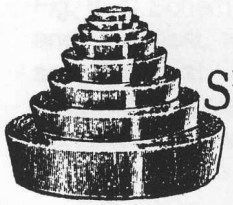


Fig. 3 Fairbanks & Co, 1859, and Buffalo Scale Co, 1894. Wall-mounted steelyard.

When was paper first classified by weight? I assume that scales were needed when paper was first made industrially, that is, on a production line, in big rolls that could be cut up into many different sizes.



Paper Weights.

SIMILAR **Weights** for ascertaining the weight of one Ream of Paper from that of one Sheet.

Paper Weights, 112 lb. down to ¼ lb. per Ream of 480, 500, or 516 sheets .. .. .. 5/- per set.

Prices for Weights for any other Number or Standard on application.

Fig. 4 W & T Avery Ltd, 1906. Other companies did supply them, but did not illustrate them in their catalogues.

The first identifiable paper scale was made by Fairbanks in 1859, (see Fig. 3.) The Fairbanks catalogue shows a steelyard for weighing one sheet of paper. [As the Americans sold scales for a closely defined function, we can identify this as a paper scale, but presumably the British also weighed paper. The British bought any one of the reasonably sensitive scales that would fulfil the function and bought paper weights separately, as still offered by W & T Avery in 1906, at 5 shillings the set, (see Fig. 4,) to go with their equal-arm scale.]

The more accurate scales weighed a whole sheet of paper and the less accurate weighed a specific sample size, often defined by drawing round the base of the scale as a template. The accuracy of the pendulum (as opposed to the steelyard or the equal arm scale,) depended upon the skill with

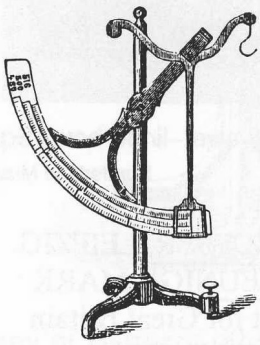


Fig. 5 F Leunig for A H Mardon of London, 1902. For demy sheets, 17½ x 22½ ", template 4" square. Also sold by G Hartner of Ebingen about 1913.

Indispensable to Paper Makers, Stationers, or Printers.

PAPER SCALES,

For showing correctly at a glance the weight of a Ream of Paper containing either 516, 500, or 480 sheets, from ¼lb. to 70lbs. per ream, by weighing a single sheet.

SOLD BY THE MAKERS,

F. LEUNIG & CO.,

ANCHOR CHAMBERS,

68, UPPER THAMES ST., LONDON, E.C.

which the scale was made, but, as a general rule, an equal arm scale weighing a whole sheet rolled up would be the most precise. The DeGrave scale shown on page 1692 was this type, but the close up on page 1691 demonstrates its disadvantage; that is, the number of weights that needed to be handled carefully and counted up to get the right answer.

The pendulum scales made by Louis Schopper and F. Leunig & Co. were characteristic of the Austro-Hungarian pendulum scales, (see Fig. 5.) They were exported widely and sold by agents. Alfred H. Mardon stated in his 1902 catalogue that he was "Sole Agent for the British Empire", and that "Perkins, Goodwin & Co., Duane Street, New York, are Sole Agents for the United States of America" for Leunig Paper Scales and Testers. A. H. Mardon was "also sole agent for all scientific Paper Testing Apparatus [including scales] manufactured by Louis Schopper of Leipzig." These quotations imply that Leunig and Schopper manufactured separately and under their own names but H. E. Messmer had his pendulum scales marked:-

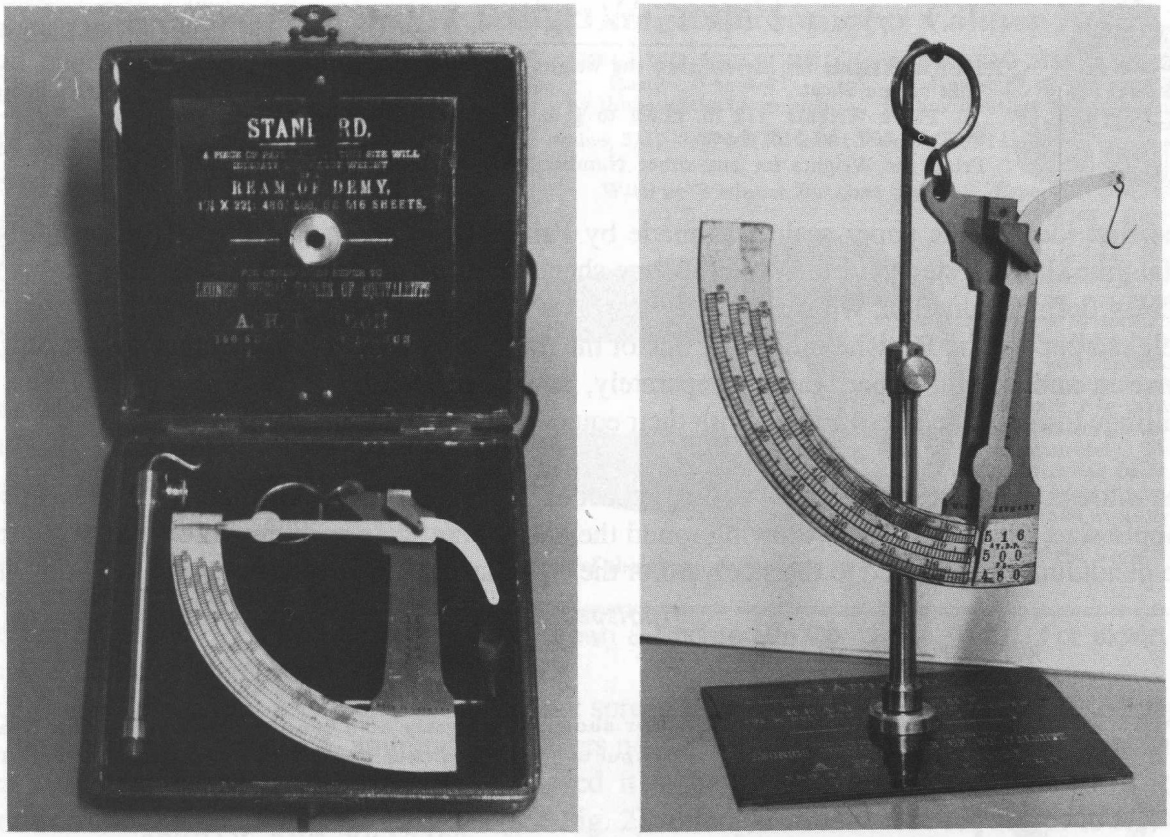


Fig. 6 By F Leunig & Co of London for A H Mardon of London. Brass in black velvet-lined box. Square base in lid has other templates behind it. Pillar extends. Sunderland Museum.

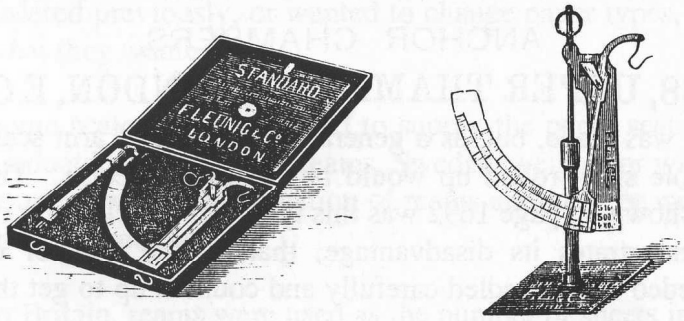


Fig. 7 By F Leunig for A H Mardon, 1902. This catalogue illustration gives us an approximate date for the scales above, although the right hand edge is a slightly different shape.

"LOUIS SCHOPPER, LEIPZIG.
TRADE LEUNIG MARK
Selling agent for Great Britain
H. E. MESSMER."

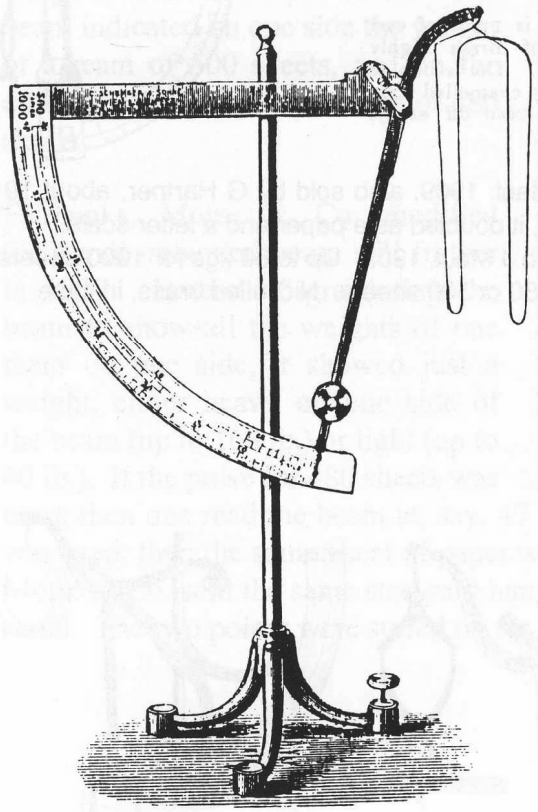
This suggests that Leunig was manufacturing Schopper's designs.

B. Nedden & Co., a British company, also had their name on a pendulum paper scale, but Leunig's name was not on the scales.

Leunig & Schopper had a competitor in C. Schember & Söhne of Vienna & Budapest, manufacturing scales from before 1862. Schembers showed a paper scale in their 1888 catalogue of classic pendulum design, (see Fig. 8.) They stated that the acknowledged superior makers of paper scales came from the Austro-Hungarian Paper Industry, a comment that today would sound like an advertising 'puff', but was probably true then.

Extremely similar scales were made by Ph J Maul of Hamburg in Germany in the early part of the 20th century, (see Figs. 9, 10, 11, and 12). The same scales were sold in about 1913 by G. Hartner of Ebingen, Germany, a specialist in the manufacture of precision scales and weights.

Fig. 8 C Schember & Söhne of Wien (Vienna) and Budapest, 1888. Factories in Atzgersdorf and Budapest. Although it looks like a Ph J Maul paper scale, there are minute differences. Schember shows Salter spring balances for sale in the same 1888 catalogue.



Papierwaagen.

Die Papierwaagen, Fig. 68

sind mit Ausnahme des lackirten Ständers aus Messing, der Gradbogen stark versilbert und zeigen durch Auflegen eines Bogens Papier das Gewicht eines Neuries zu 1000 oder eines Altries zu 480 Bogen an.

Wir beschränken uns hier nur auf die Thatsache, dass unsere Papierwaagen, trotz der mannigfachen Concurrenz, bisher in Bezug auf die Verlässlichkeit der Abwaage nicht erreicht wurden und von der Papier-Industrie Oesterreich-Ungarns als das vorzüglichste Fabrikat anerkannt werden.

Bogen in Ries	Tragkraft in Kilogramm	Nummer der Waage	Preis per Nummer
480/1000 oder 500/1000	15/30	7	14.—
	20/40	8	20.—
	25/50	9	20.—
	30/60	10	20.—
	40/80	11	23.—
	50/100	12	28.—
	60/120	13	28.—
	75/150	14	30.—
500/1000	10/20	15	30.—
480/1000	10/20	16	30.—
480/500	10/10	17	30.—

480/1000 = 50 Wiener Pfund = 60 Kilogramm

Nr. 18 fl. 28.—

Reise-Papierwaagen in Leder-Etui à fl. 13.—

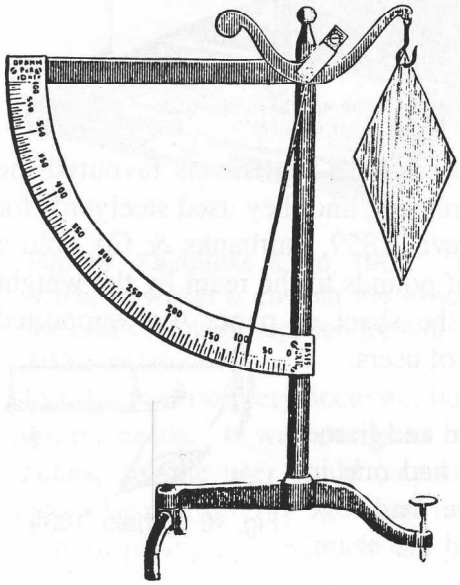
Bemerkungen.

Bei Bestellungen ersuchen wir um gütige Angabe der Nummer, Tragkraft und Riesbestimmung zu 480/1000 oder 500/1000 Bogen. Die Papierwaagen sind durchgehends in ½ Kilo eingetheilt, mit Ausnahme von Nr. 15, 16 und 17, welche für Cigaretten- und Seidenpapier-Wägungen bestimmt, von 10 zu 10 Deka, d. i. 1/10 Kilo getheilt, und, diesen Zwecken entsprechend, sehr empfindlich construirt sind.

Auf besonderen Wunsch können auch die Waagen Nr. 7 bis 14 in ¼, ⅛ und 1/10 Kilotheilungen geliefert werden; selbstverständlich erhöhen sich hiedurch die Preise der einzelnen Nummern.

Wir erlauben uns die besondere Aufmerksamkeit darauf zu lenken, dass sich die Theilung an unseren Waagen gut ablesen lässt, was bei Waagen der Concurrenz nicht immer der Fall ist, da dieselben möglichst billig hergestellt, auf dem nur denkbar kleinsten Radius ihre Theilung erhalten. So kann eine Waage Nr. 12 mit dem Radius einer Waage Nr. 10 versehen werden, wodurch sich der Preis um 30% verringert; die Theilstriche jedoch so enge aneinander kommen, dass das Ablesen ein unsicheres und zeitraubendes wird; abgesehen von der leichten Anarbeitung solcher Waagen, welche durch die hiedurch eintretende stete Vibration eine genaue Abwaage nicht zulassen.

Many of Hartners' other scales were also identical to those sold by Ph J Maul, and as Ph J Maul was a specialist in the manufacture of pendulum scales, presumably Maul was supplying Hartner, and not the other way round.



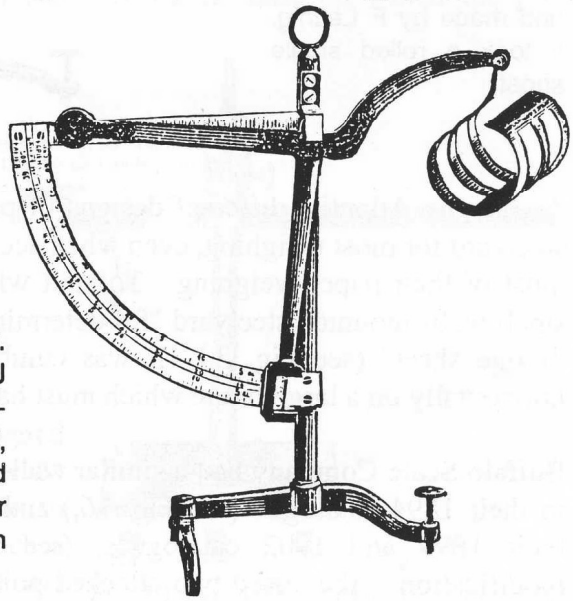
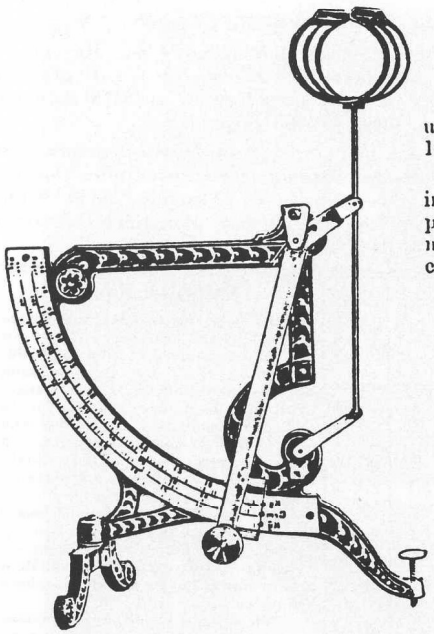


Fig. 9 & 10. Both Ph J Maul of Hamburg, 1909, and both sold by G Hartner of Ebingen in about 1913.

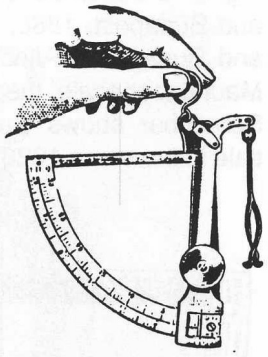


New Model, very good value

Height 40 cm

For 480—500 sheets divided in ½ kgs. up to 50 kgs. and with Letter Scale up to 100 gr. in single gr.

The very strong stand is made of cast iron. The other parts of Brass highly polished and nickel plated. The scoop is made of Aluminium and the enamelled scale enables the weights to be read off easily.



< Fig. 11 Ph J Maul, 1909, also sold by G Hartner, about 1913. As the text stated, it doubled as a paper and a letter scale.
Fig. 12, above. Ph J Maul, 1909. Up to 60 kgs for 1000 sheets or up to 30 kgs for 480 or 500 sheets. Nickelled brass, in case.

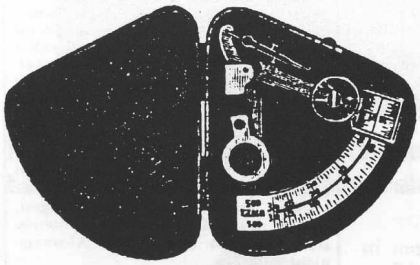
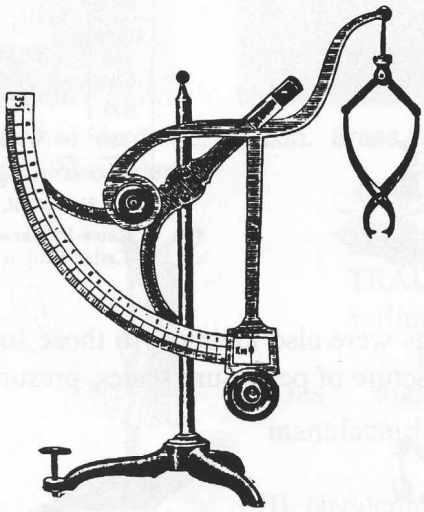
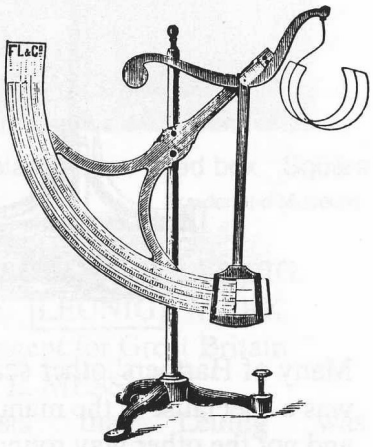


Fig. 13, 14 and 15. All sold by G Hartner about 1913. Fig. 15 also sold by A H Mardon in 1902, and made by F Leunig. It took a rolled single sheet.





Can also be made to indicate in addition to the English weight, the weight in kilogrammes, Swedish weight, or the standard weight of any other country.

Across the Atlantic, different designs of paper scale were used. The Americans favoured the steelyard for most weighing, even when accuracy was a requirement, and they used steelyards for most of their paper weighing. To start with the earlier known, 1859, Fairbanks & Co. sold a small wall-mounted steelyard "for determining the number of pounds to the ream by the weight of one sheet" (see Fig. 3.) It was cumbersome because the sheet of paper was supported horizontally on a large frame which must have got in the way of users.

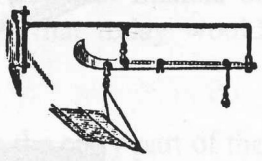
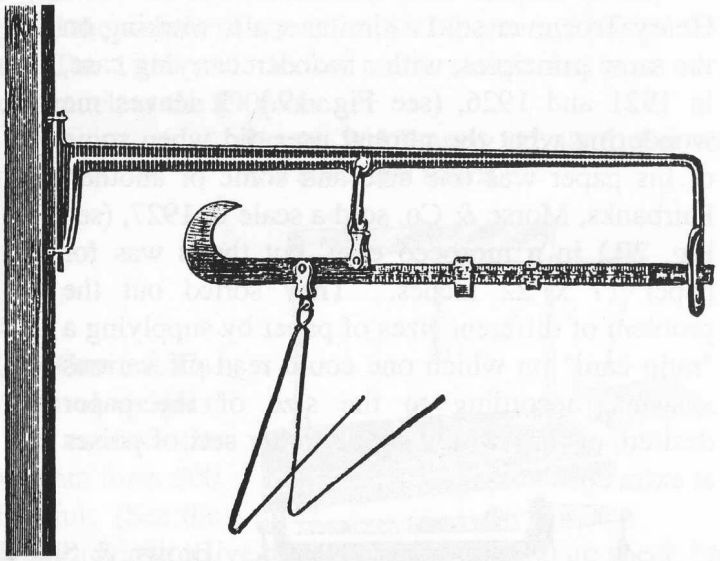


Fig. 16 Buffalo, 1894

Buffalo Scale Company had a similar wall-mounted steelyard and frame in their 1894 catalogue (see Fig. 16,) and Howe Scale Co. had one in their 1899 and 1902 catalogues, (see Fig. 17.) Howe had one modification – they used two attached poises wrapped round the beam,

(instead of using a poise hanging loosely below the beam,) the smaller one to be used when the paper weighed 40 lb. per ream or less, the larger poise when the paper weighed 40 pounds or more per ream. The beam indicated on one side the weight of a ream of 500 sheets, and on the other side the weight of a ream of 480 sheets.

Fig. 17 Howe Scale Co, 1899 and 1902 Smaller poise for 40 lb. per ream or less. Large poise for more that 40 lb. per ream. One side of the beam for 480 sheet ream. Other side of beam for 500 sheet ream.



Fairbanks, Morse & Co. modified their wall–mounted beam still further in 1927. Instead of graduating the beam to show all the weights of one ream on one side, it showed just a weight, either heavy on one side of the beam (up to 160 lb.) or light (up to 40 lb.). If the poise for 480 sheets was used, then one read the beam at, say, 47 lb. for a 480 sheet ream, or, if the poise for 500 sheets was used, then the same sheet of paper would read off at 49 lb. for a 500 sheet ream. Fairbanks, Morse & Co. sold the same steelyard hanging from a bracket on a pillar on a handsome lion–foot stand. The two poises were stored on the bracket.

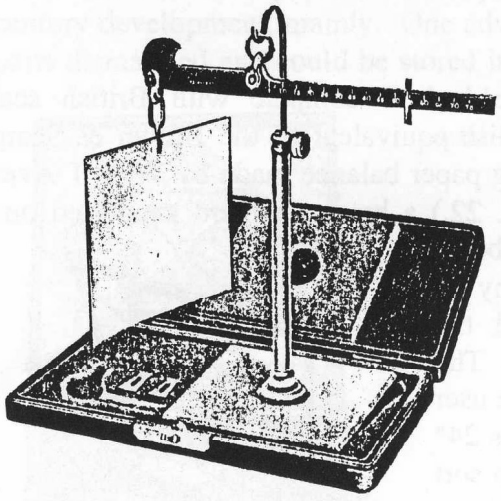


Fig. 18 Fairbanks & Co, 1906. Travellers' scale, to weigh a sample the exact size of the base. Poises supplied for 400, 480 and 500 sheet reams.

Going back to the beginning of the century, Fairbanks & Co. offered paper sampling scales for determining the number of pounds per ream by the weight of a small sample, (see Fig. 18.) The scale could be dismantled and stored in its velvet–lined morocco case. As the weighing was of a small piece of paper (the size of the base on which the pillar stood) it was not very accurate, but it probably answered normal needs. It was designed only for paper 18 x 24 inches, but the user could calculate for sheets 24 x 36 inches by multiplying by 2, and for sheets 16 x 22 inches by multiplying by 0.815. It had poises for reams of 400

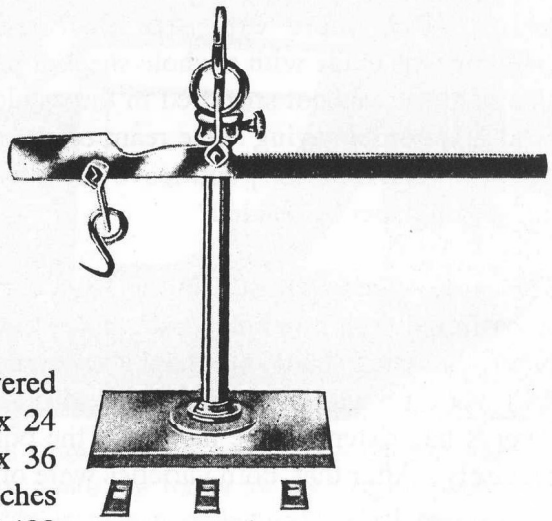
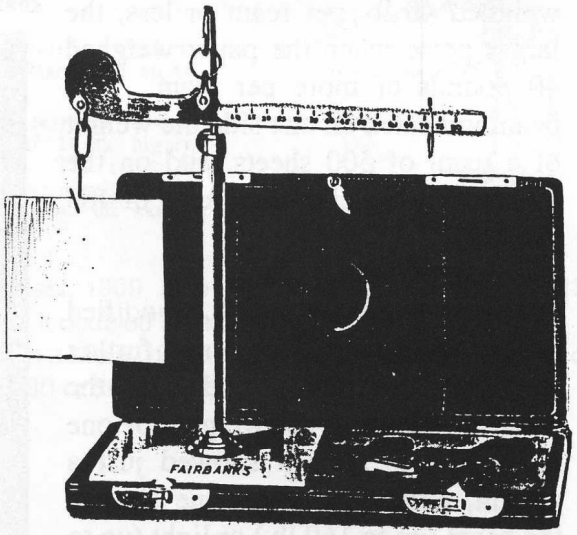


Fig. 19 Henry Troemner, 1921 and 1926.

(unique to America, as far as I know,) 480 and 500, or the buyer could order an extra poise for a ream of 516 sheets.

Fig. 20 Fairbanks, Morse & Co, 1927. Supplied with a 'ratio' card, to save the user from having to calculate the weight of sheets other than 17 x 22 in



Henry Troemner sold a similar scale, working on the same principles, with a wooden carrying case, in 1921 and 1926, (see Fig. 19.) It leaves me wondering what the normal user did when some of his paper was one size and some of another. Fairbanks, Morse & Co. sold a scale in 1927, (see Fig. 20,) in a morocco case, but theirs was for paper 17 x 22 inches. They sorted out the problem of different sizes of paper by supplying a "ratio card" on which one could read off various answers, according to the size of the paper desired, or they would supply other sets of poises at extra cost.

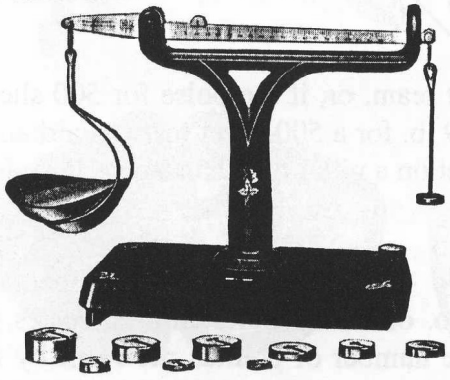


Fig. 21 Brown & Sharpe Mfg. Co, 1927. Adapted for samples of paper.

Brown & Sharpe Mfg. Co. sold a small bifurcated pillar scale which could be adapted to weighing paper, (see Fig. 21.) It had the refinement of a spirit level set into the base. As Brown & Sharpe exported the scales to Britain, they supplied the scales with English graduations. The graduations for paper were not specified in their 1927 catalogue.

Brown & Sharpe had to compete with British scale makers. The British equivalent of the Brown & Sharpe was the estimating paper balance made by W & T Avery in 1880, (see Fig. 22,) a brass steelyard supported on a curved brass pillar, with a supporting pillar to locate the beam and prevent wear. The base was made of mahogany or marble (10% more expensive than mahogany), and the estimate was made with a whole sheet of paper rolled up. The size of sheet was not specified in the catalogue. Did the user send in an order saying "One ream of my paper, which is 24" by 35", weighs 54 lb.", and leave the paper company to sort out which paper he needed?

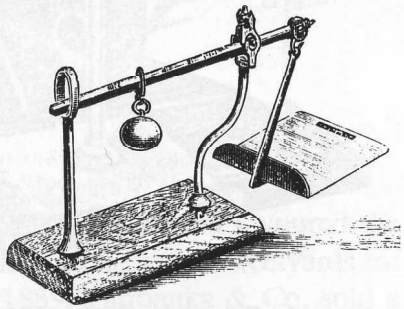
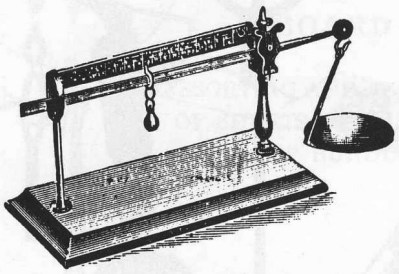


Fig. 22 W & T Avery, 1880, and W & T Avery Ltd, 1898 and 1906. Class 1 sensitivity.

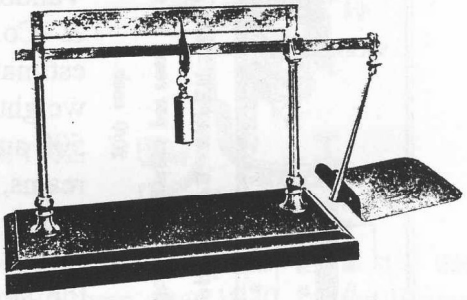
The same scales were still in the 1898 catalogue, but Averys also offered their more elaborate table steelyard which had an ivory graduated "card" mounted above the steelyard, (see Fig. 23.) The card was large enough to indicate the weight per ream of 480, 500 or 516 sheets, and, as Averys had extended the hanger of the poise upwards to form a pointer, the card could be read precisely. After that, both varieties were offered in the 1906 catalogue.

Fig. 23 W & T Avery, 1880 and W & T Avery Ltd., 1898 and 1906. 'Ivory Index Scale.' Took a whole sheet of paper, rolled. Cost 45/- in 1898 and cost 70/- in 1906.



A modified version of the second variety was in the 1916 catalogue, (see Fig. 24) with a plain pillar, and Sharkey bearings (instead of oval box ends) and a plain cylindrical poise (instead of the traditional pear-shaped poise). It estimated the weight of a ream of 480 sheets and one of 504 sheets. The 1916 scale looked more severe and cost over twice as much as the 1906 one.

Fig. 24 W & T Avery Ltd, 1916. For 480 and 504 sheet reams.



As was illustrated on page 1692 of EQM, DeGrave & Co. made equal arm scales on a pillar with sets of weights, nicely shaped so that the user would not confuse the weights for a 480 sheet ream with the weights for a 500 sheet ream. W & T Avery were not so helpful. (See the Cover Picture.) They made a similar scale with an attractive hanger to hold a rolled up sheet, but all four sets of weights looked the same, so that the user had to be very careful. It must have been very easy to get three weights from one stack and one from another, forgetting to read the number stamped on the rim, then adding up and getting the wrong answer. The four sets of weights were for the conventional 480, 500 and 516 sheets to the ream, plus one for 510 sheets. This is not a ream found in any of my reference books, but the weights for it are made of white metal, a 20th century development, mainly. One advantage of the W & T Avery scale design was that all the parts dismantled and could be stored in the drawer, including the hanger, so that the user could travel with the scale and still have the greater precision of an equal-arm scale (unlike the travellers' pendulum paper scales).

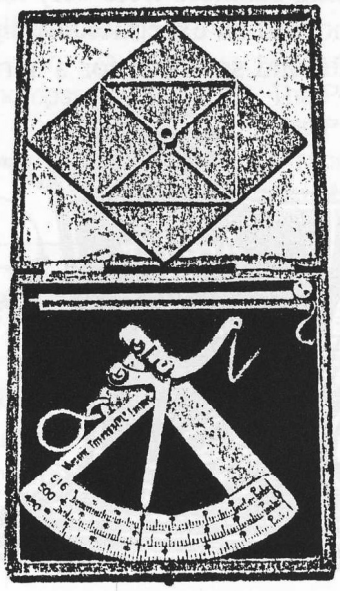


Fig. 25 Vandome, Titford & Co Ltd, about 1912. For travellers. Could be hand-held or hooked onto the pillar.

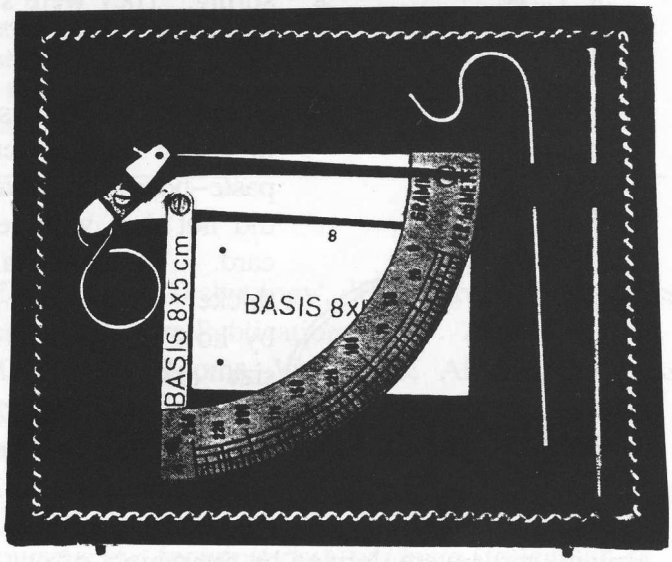


Fig. 26 These modern scales measuring in grams per square metre are made for yarn or for paper. The only difference is in the template, which needs pins to hold cloth steady.

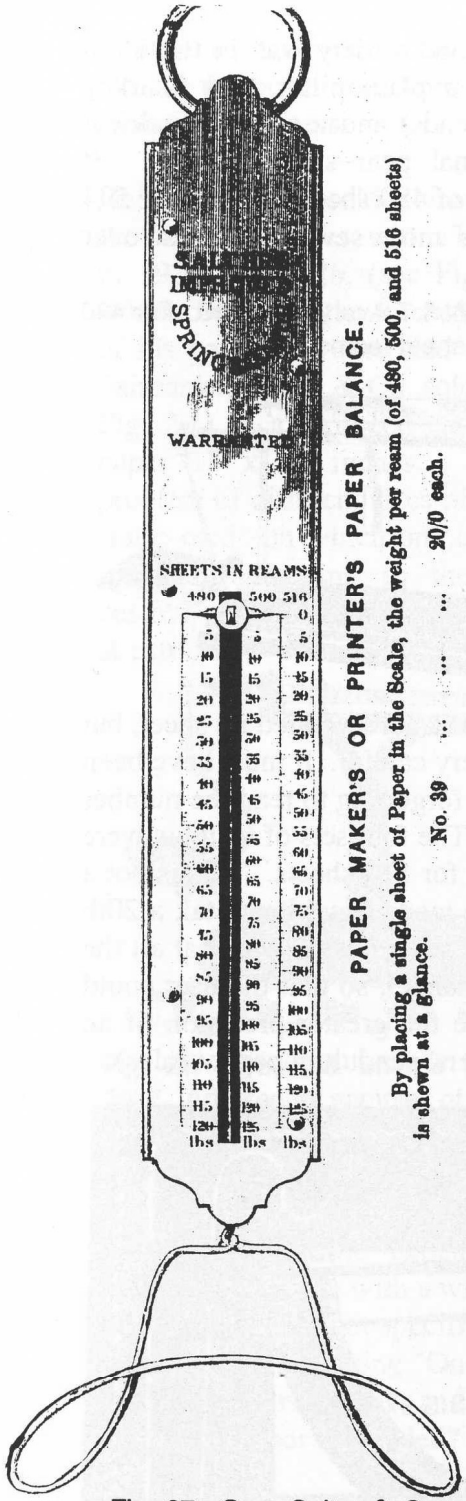


Fig. 27 Geo. Salter & Co, 1893.

Vandome, Titford & Co. Ltd. sold a travellers' pocket pendulum scale in about 1912, (see Fig. 25,) very similar to the Ph J Maul pendulums. It was stamped Vandome, Titford & Co. Ltd., and estimated the weight of 480, 500 and 516 sheet reams, of sheets 17½ x 22½ inches. That was the Demy size for drawing, chart and plate paper.

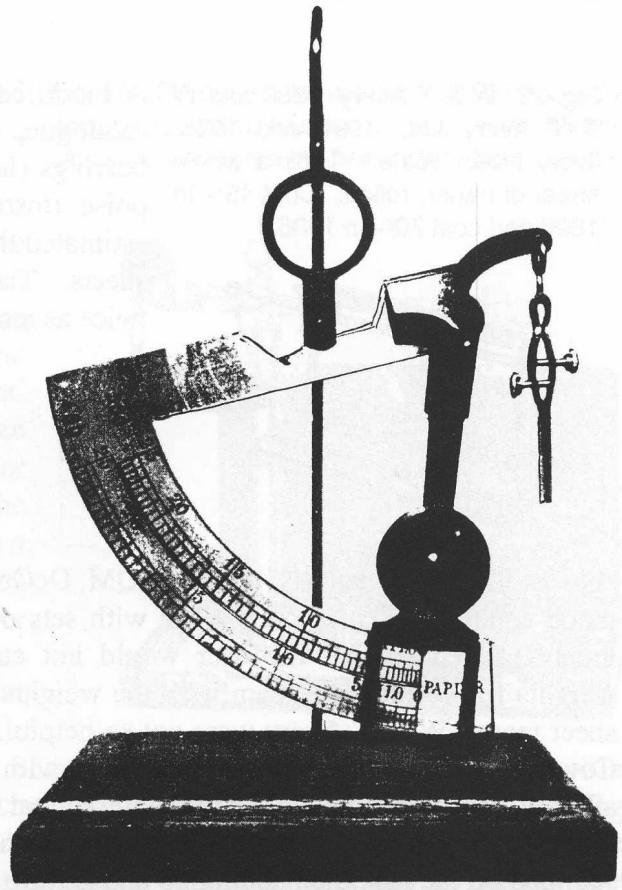


Fig. 28 Made for the Netherlands. Note the two screws in the clip, giving a better grip on thin, slippery papers. Date unknown. Perhaps about 1905?

A rare type of paper scale in the British catalogues was the 1893 Geo. Salter & Co. spring balance, (see Fig. 27.) These spring balances were very long, with a face about 12 inches long, and housed an exceptionally light spring. They were surprisingly accurate and sensitive for a spring balance.

Board scales were supplied to weigh the heavier cards, paste–boards and boards, but did not deal with reams of card. In America, these thicker cards were defined by how many cards of that size and thickness would weigh 50 lb. John Chatillon & Sons supplied a dial–faced board scale in 1894 & 1924, with a robust clip for the board. (See Fig. 30.) In Britain, cards were defined by the weight of one card in pounds and ounces, or how many cards of that thickness weigh 1 cwt. In 1902 Mardon supplied F Leunig's pen–dulum board scales to the British Empire, (see Fig. 31.)

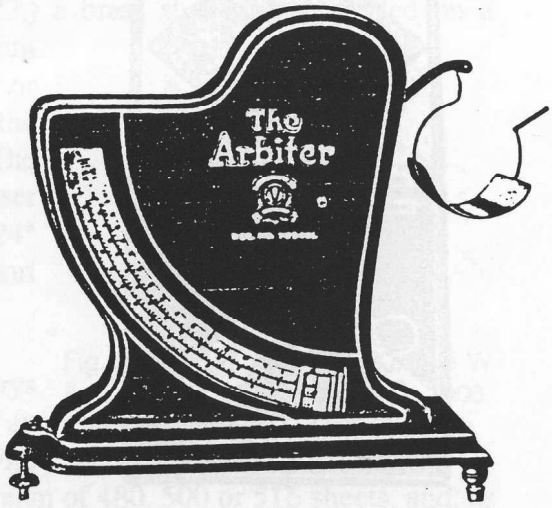


Fig. 29 Vandome & Hart Ltd, c. 1935. "Gives Instant Indication without Oscillation." A pendulum scale with patent oil cushion.

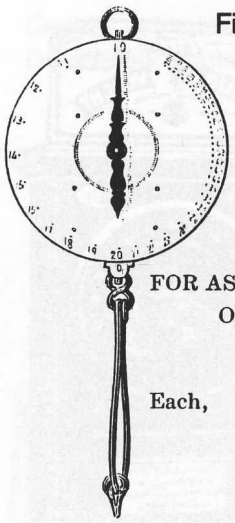


Fig. 30 John Chatillon & Sons, 1894

BOARD SCALES.

FOR ASSORTING AND ASCERTAINING THE NUMBER OF SHEETS OF PASTEBOARD TO MAKE UP BUNDLES OF 50 LBS.

Each, ... $16 00

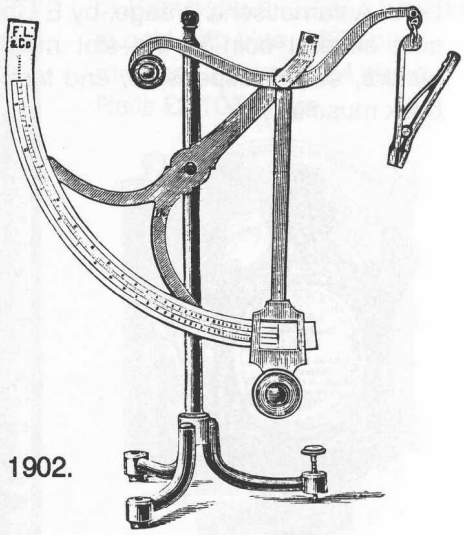


Fig. 31 F Leunig for A H Mardon, 1902.
Also for boards.

It is impossible to say when paper scales stopped being used, in that a few paper mills still use them today, and also because scale companies would still supply them after 1930, by modifying their estimating scales to estimate paper.

With thanks to Sjeord Bruinsma for his assistance with translation from the Netherlands 'Meten & Wegen' magazine, pages 546 and 565, of articles by ex-ISASC member, Guus Thürkôw, about the paper reams used in Holland, .
With thanks to Alan Simpson of the National Museum of Scotland for his help with the paper scales in the collection of the National Museum of Scotland in Edinburgh, reference number T.1993, 84.
With thanks to John Hitchins for his help with current printing practices.
With thanks to Lou uit den Boogaard for material taken from his article in Meten & Wegen, page 1360.

References

Hunter	Paper Making.
Thompson, A G	The Paper Industry in Scotland, Edinburgh, 1974.
	The Present State of Great Britain, London, 1738.
Zupko, R E	Dictionary of Weights and Measures for the British Isles, Philadelphia, 1985.
	Act of Parliament, 10. Anne. 19.

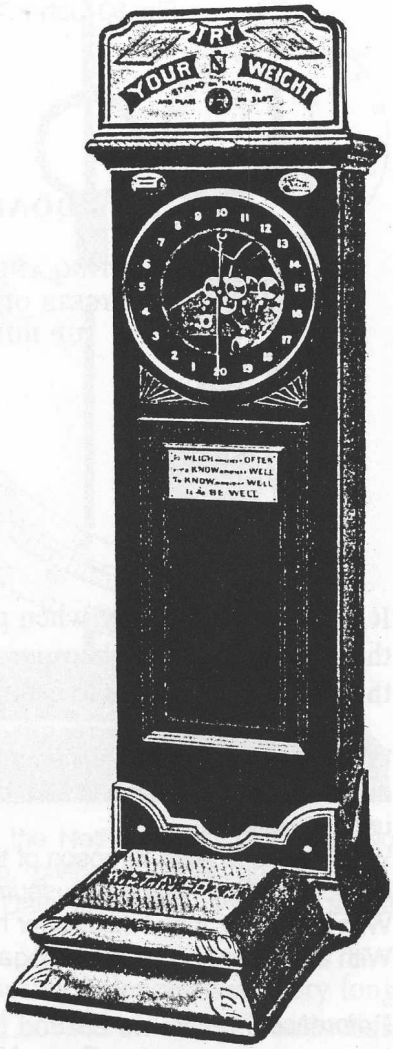
Review

A paper in 'Working Papers 1, Studies in Design and Technology', **'Coin-freed Weighing Machines from 1884 – 1940'** by Claudia Kinmonth, Future Publications, 1987. Available from Katrina Royale, Secretary, V & A/RCA MA Course Rooms, Victoria & Albert Museum, Exhibition Road, London SW7. 6 scales illustrated in black and white. 45 pages. Price retail, in sterling only, £10 within Britain, £12.40 to Europe and £15 to US, including packing and postage.

The author prepared this work as part of her course at our foremost post-graduate College of Art and at the Victoria and Albert Museum (the large museum set up with the proceeds of the Great Exhibition of 1851) which has the remit of covering top quality design of ornamental and useful

Left. Automatische Waage, by E Ubrig & Co of Berlin, 1892. Ubrig sold several coin-in-the-slot machines, including hand-strength testers, sweet dispensers, and test-your-strength vertical pull (for back muscles.)

On right, W & T Avery Ltd, 1912. "An automatic money-earner with handsome iron frame for outdoor position. No risk – all the takings are profit"

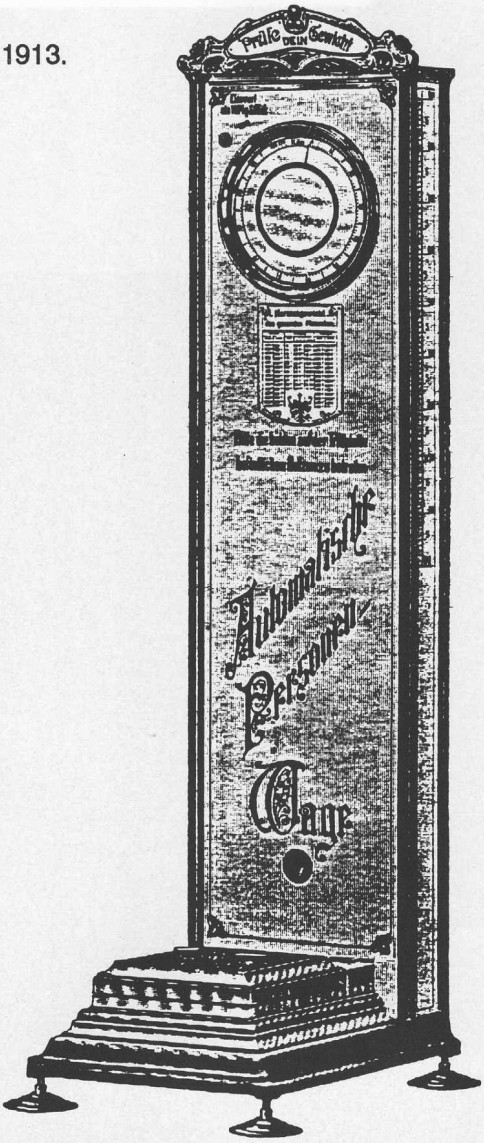


Above. W & T Avery Ltd, 1912. "Doctors Insist on People Weighing Themselves Periodically– most People do so on these Machines. For Rinks, Theatres, Music Halls, Exhibitions, Hotels, Clubs and all Indoor places of Public Resort. Every Penny Taken is a Penny in YOUR Pocket. Capacity 20 Stone."

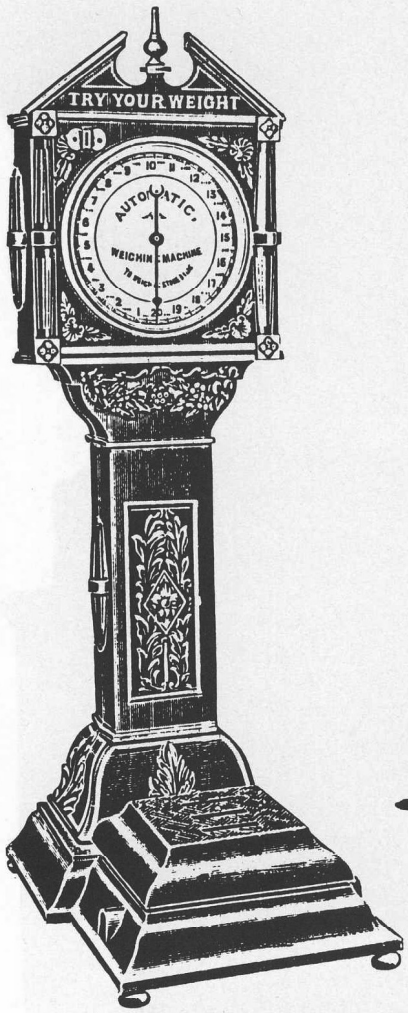
objects. Her subject is entirely appropriate to these aims, but she makes no claims to being an engineer, so her 45 pages are more about eye appeal than about mechanics. Scale collectors will be disappointed by the fuzzy, indistinct, frankly abysmal illustrations, but no blame attaches to the author – they are atrocious throughout all eight studies in the book.

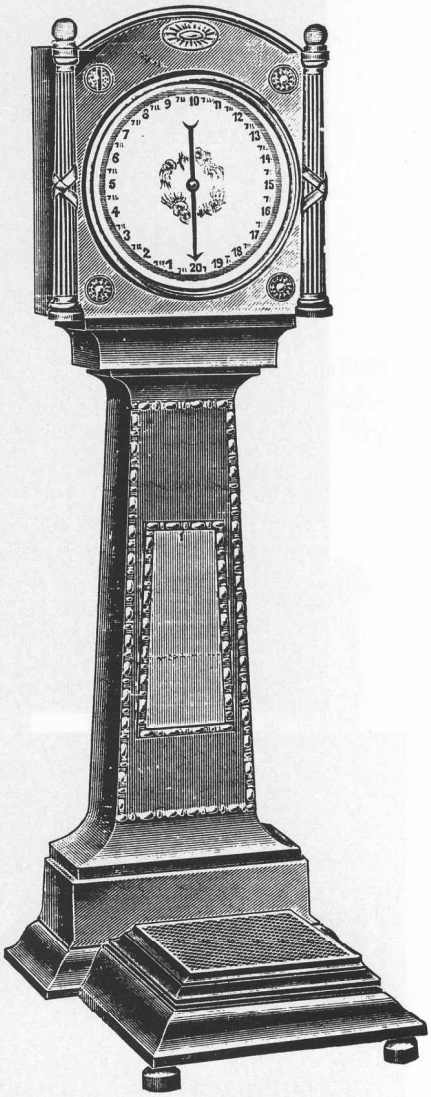
So we ignore the illustrations and concentrate on the text. The author draws on numerous catalogues (Avery, Salter, Day & Millward, Caille Brothers, Toledo, Berkel, Carnegie & Layton),

Centre. G Hartner of Ebingen, 1913. Deutches Patent 146724.



Below. Carnegie & Layton Ltd. of Birmingham, 1928. Finished in gold with blue, white or maroon. To weigh 24 stone. Rails £2/10/0 extra.





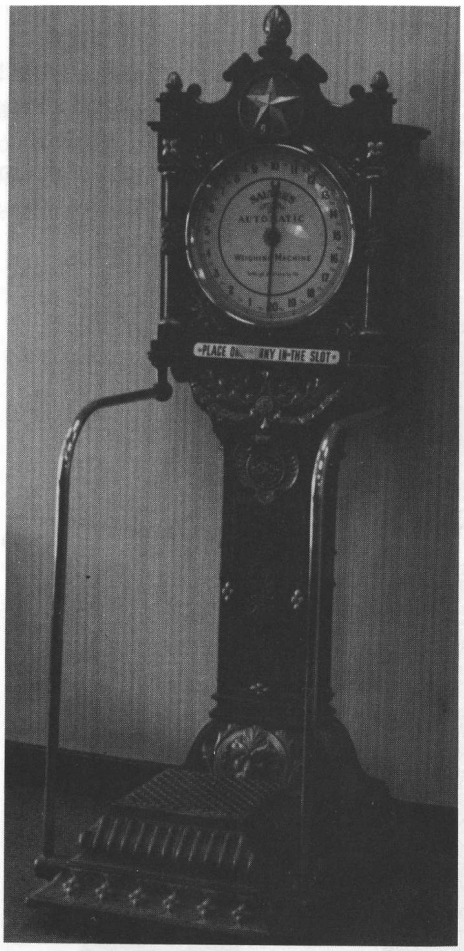
Left. Day & Millward of Birmingham Ltd, 1924. "Very suitable for Parks, Pleasure Gardens, Hotels, Exhibitions. Weighs 20 stone. Brass rails £5 extra."

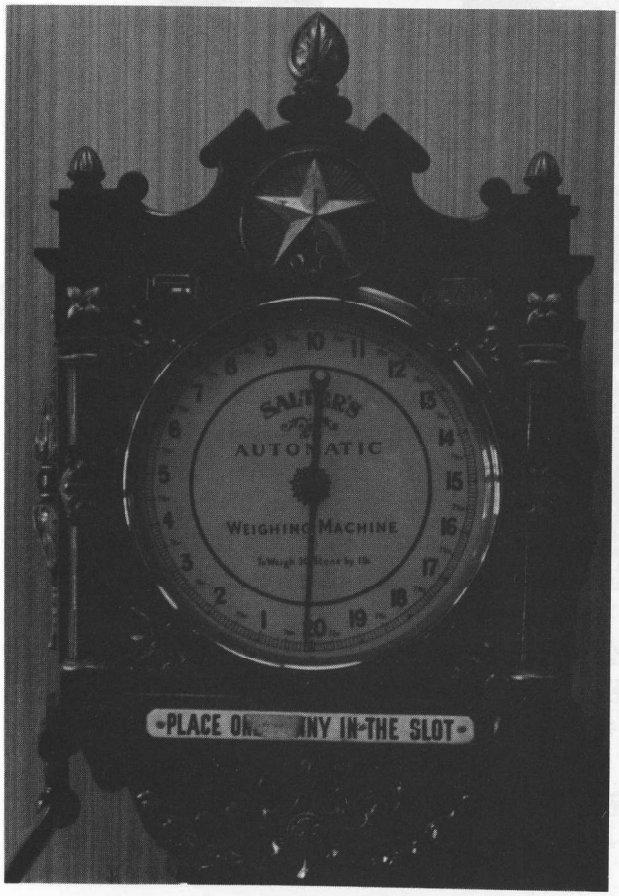
and the common reference books (Saunders, Kisch, Broadbent, Patent Records, The American Weigh, Grahams' Scales & Balances,) to produce an excellent résumé. She discusses the social history of weighing, dealing thoroughly with the attitudes of the buyer / renter of the scales, as well as those of the user. She demonstrates the differences between pendulum and spring scales, explains design features relating to the trade of the designer, the use of materials, repair needs, the image projected relating to fun, health & hygiene, and the need for vandal-proofing.

The limitation that most affected the author was the difficulty of finding surviving examples to examine. Given this problem, the author must be congratulated on producing a coherent and interesting paper.

The rest of the book is equally stimulating, covering varied subjects including linoleum, pillar boxes, bricks and waterproof garments. Great fun!

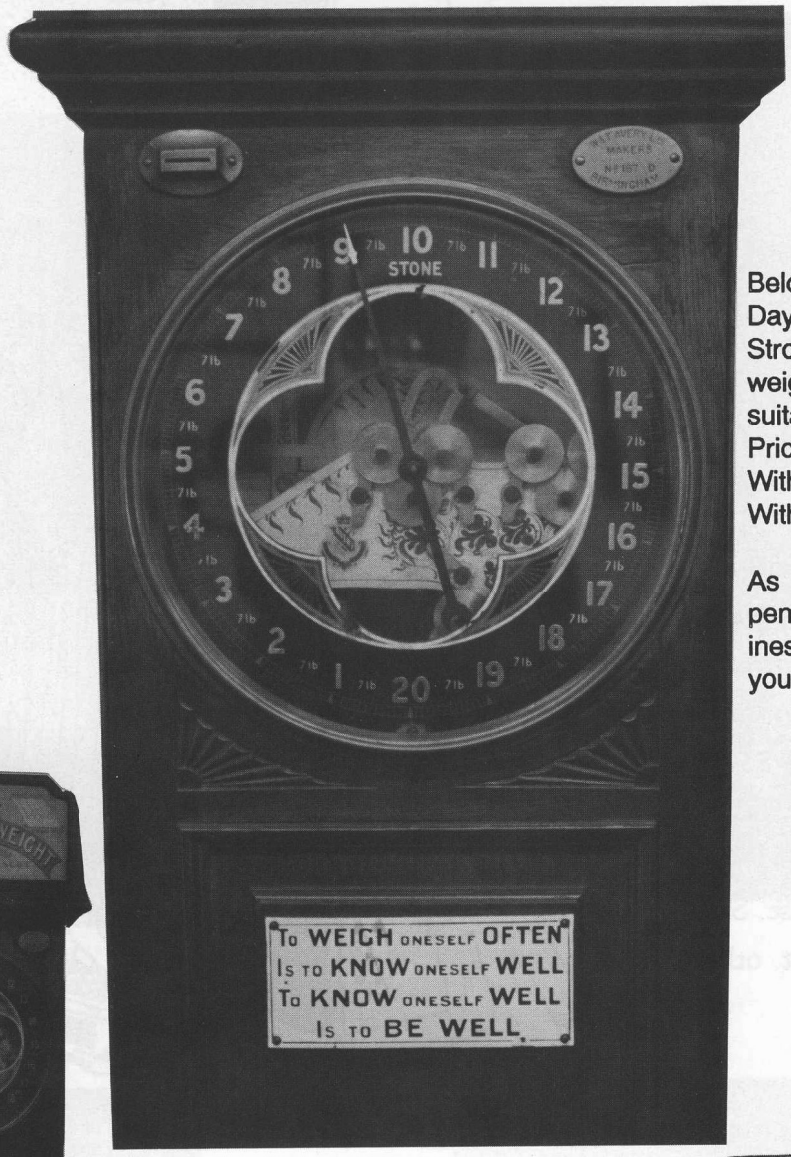
D F C-H





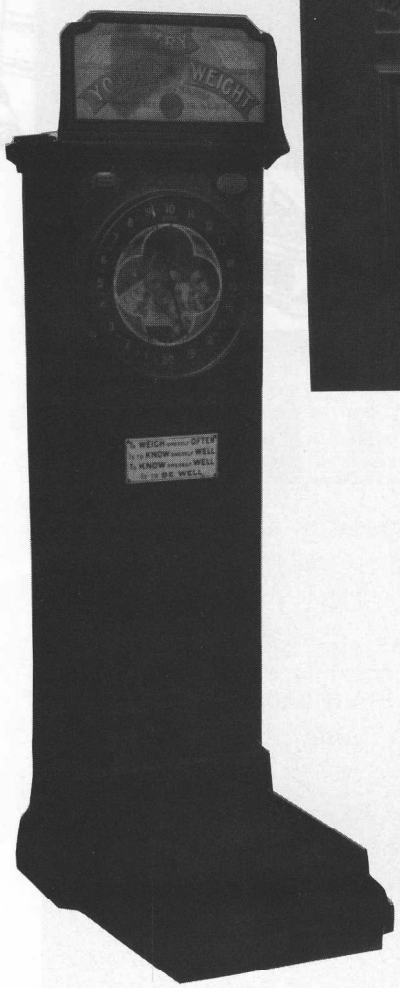
Geo. Salter & Co, West Bromwich, with the Salter trademark of the Staffordshire knot with an S.
Decorated in British racing green, with lime green highlights and gold fine detail.
Salter's automatic weighing machine. To weigh 20 stone (280 lb.) by 1 lb.
Place one penny in slot.
Number 460.

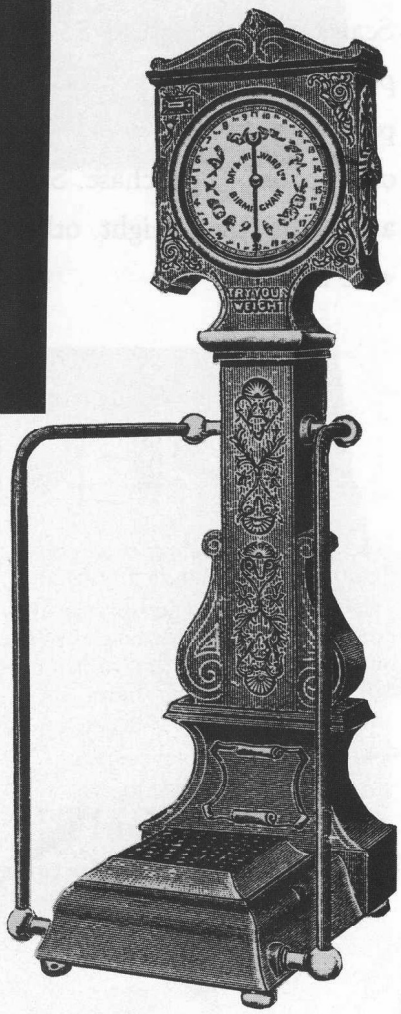
Red Meade collection.



Below.
Day & Millward, 1924
Strong and handsome weighing machine, very suitable for clubs etc.
Price £54.
With iron rails £57.
With brass rails £60.

As with nearly all British penny-in-the-slot machines, it had on the front "Try your weight."





Above and left.

W & T Avery Ltd.
Makers
No. 167 D
Birmingham

To weigh oneself often
Is to know oneself well.
To know oneself well
Is to be well.

Red Meade Collection.

MORE PENNIES.. MORE SALES..

Scale receipts are **profits** . . . no maintenance or operating costs. Earnings, as reported by actual users of Hanson Penny Scales, run as high as $31.00 per month. And the folks who pause to learn their weight, often pause to purchase. Sales are made that might otherwise be lost.

PENNY SCALE

In glistening genuine porcelain . . . this Hanson Penny Scale **demands** attention . . . and gets it!

Yet it requires a floor space of only 12x16 inches. And it does not hide displays because its height is but 36 inches and the width of the column only 5 inches. Set it anywhere.

Women like the privacy of the semi-concealed dial. Easy to read.

Maintenance is limited to wiping off the shiny surface of genuine porcelain and removing the pennies. Not even oiling is required.

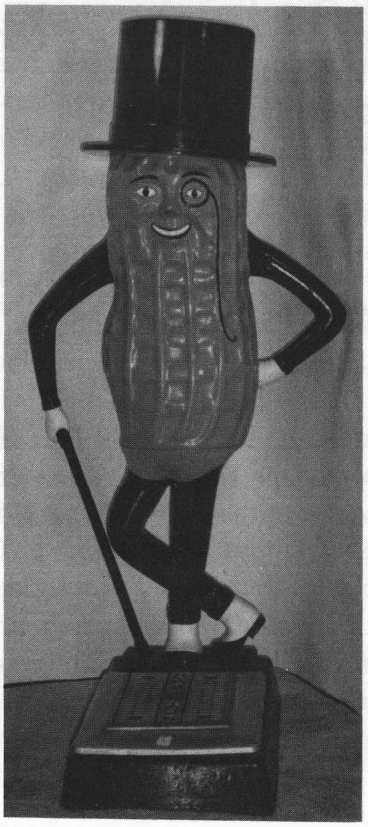
People can always afford a penny for weight information. And every type of business has a place for a Hanson Penny Scale. The cost is moderate, upkeep is nil . . . and earnings are all profit.

WEIGHT! . . . what an interesting fact to know. Rare is the woman who fails to be concerned with what the scales tell her, whether she is dieting to repel accumulating ounces or seeking healthy return to normal weight. With children, gain or loss is often the gauge of health. And wise men heed the warnings of weight change.

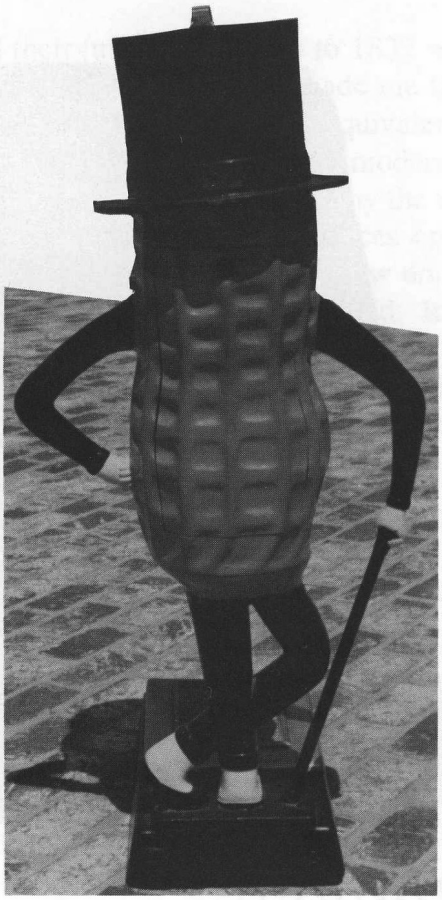
1935

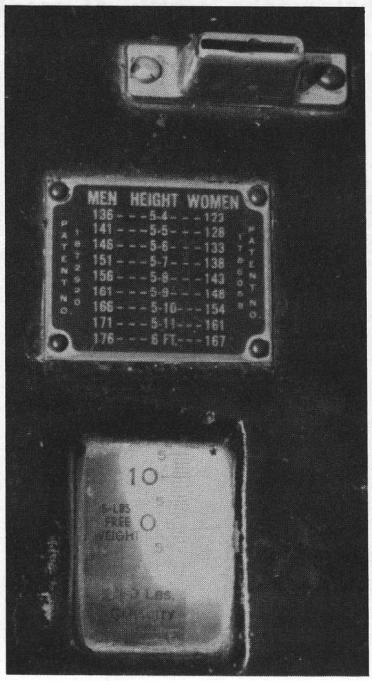
HANSON

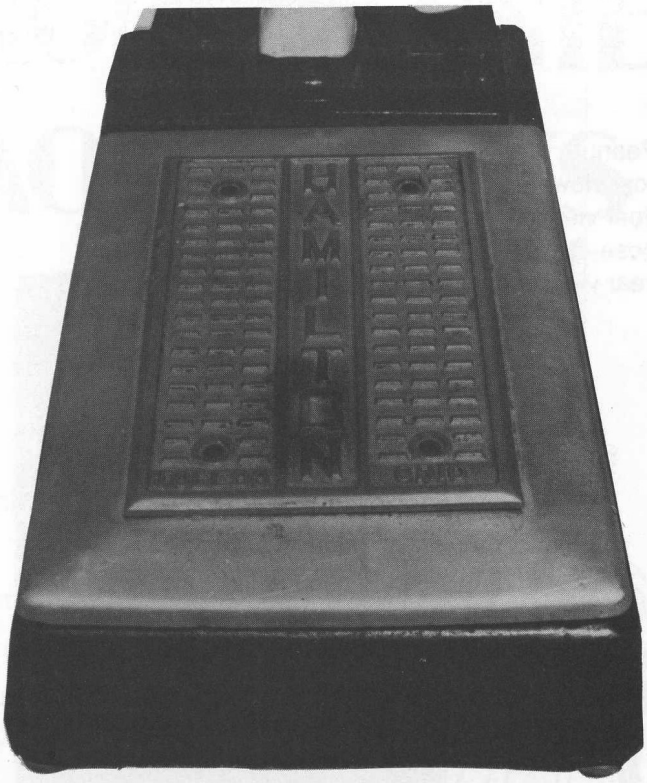
1710



Mr Peanut
Left, front view
Right, rear view
Below left, close-up of top
Below right, rear view of hat







Mr Peanut, view of the platform.
Hamilton, Toledo, Ohio.
MFG BY THE HAMILTON SCALE CO., TOLEDO 4, OHIO
Person weighing model
Capacity 280 lbs.
No. 557
Patent Number 1872920
Patent Number 1786058
Yellow nut with black hat, arms and legs, with white gloves and spats. Black walking stick and shoes.
Rentzer Collection and B. Berning Collection.

Do any of our readers have any information about the history of the Hamilton Scale Co? Is it the predecessor of the Toledo Scale Co?

Review

'Steady as She Goes, A History of the Compass Department of the Admiralty' by A. E. Fanning, published by HMSO, 1986. Available from bookshops or from HMSO Publications Centre, PO Box 276, London SW8 5DT. 460 pages, 165 black & white photographs, mostly of people. Price retail £9.95 *plus* packing and postage if ordered from HMSO.

A brief review, for those amongst our collectors who are interested in the uses of all instruments:– Although this book needs a reasonable understanding of geophysics, it demonstrates many points that must be considered by any person studying the history of any instrument, including scales. Because functional compasses are essential to the safety of all on board a ship, any malfunction or inefficiency causes dramatic consequences, that demand rigorous reappraisal of the instrument. This reappraisal is rarely undertaken in relation to scales, and so we tend towards sloppy thinking and a relaxed attitude towards innovation. We would not be so casual if compasses were at the centre of our research!

The introduction is basically a summary of compasses and their (un)reliability up to 1837 when the Admiralty Compass Committee was set up. This chapter is fascinating and made me think seriously about scale developments over the same period. Early compasses were equivalent to equal-arm, ring & hole end beams - simply made, empirical objects that worked moderately well in ordinary circumstances, with the physical laws governing them being ignored by the user. When accuracy was demanded, the ship's crew was at a loss to explain the influences on the compass, and was thus unable to improve it. Systematic scientific observation by a few dogged men slowly recognised the influence of hard iron, soft iron and the earth's magnetic field. In the development of scales, it was scientific men who encased scales, tried to reduce flexing with new designs of beams and tried new materials for bearings to reduce friction. The improvements filtered down to "ordinary" scales, when buyers saw the advantages of spending extra money to achieve greater accuracy.

This throws up the essential difference between the history of the developments of the two instruments.

The men who bought ships failed to take advantage of the latest understanding of influences on compasses and failed to supervise their construction, storage and replacement. Contrast that damning situation with the men who bought scales. They were much closer to the end-user, and saw immediate losses in their income if the scales were unreliable or inaccurate. The buyer of scales was, in effect, supervised by the Weights and Measures inspector, and knew that the law would be applied to him if he sold light weight. No such penalty clouded the horizons of ship-owners. Britain lost a ship a day, but nobody was penalised for having unserviceable compasses.

The men who paid for the compasses were senior men who had retired from active service, and had all the normal reluctance of the elderly to move on to new instruments. They failed to take account of the results of meticulous research, and because of their great buying power, held back instrument makers who could have applied the results. Contrast that with the rapid introduction of platform scales when toll roads were built, and the speed with which roberval scales were adopted for trade. Perhaps the adoption of spring scales and pendulum scales was rather slow, considering the advantage that could be derived from immediate read-out of the weight. This book provokes such thoughts, and research into scales should benefit from considering them.

Two subsidiary points arose. I had not heard of Edward John Johnson (1794-1853) previously, but what an admirable person! He did years of meticulous research, wrote lucid reports, worked tirelessly to make sure that Naval compasses were as good as possible at that date, and resisted the prejudices of his time by employing a former sergeant of artillery as his partner, in effect, if not in name.

Secondly, I did not know that "our" T. C. Robinson, the precision balance innovator, was instrumental in developing new compasses in 1840, or that he contracted to make them in quantity.

'Steady as She Goes' continues with fascinating chapters about the improvements in design - and peculiar trials, such as a Schickert's principle weight under the compass, in an attempt to prevent the compass card from oscillating in bad weather. The failures to adopt the most effective compasses are a lesson in the need for comparative trials, and a lesson in the necessity to listen to

the departmental inventor, as well as to the charming and powerful (such as Lord Kelvin.) The later chapters did not throw light on scale developments for me, but that may well have more to do with my ignorance of modern designs of scales than with any lack of comparisons. D F C–H

Review

'Science Preserved, a directory of scientific instruments in collections in the United Kingdom and Eire' by Mary Holbrook (with additions and revisions by R W G Anderson and D J Bryden), published by HMSO, 1992. Available from bookshops or from HMSO Publications Centre, PO Box 276, London SW8 5DT. 270 pages, 139 black & white photographs. Price retail £35 *plus* packing and postage if ordered from HMSO.

To quote the publishers *"Science Preserved is the Domesday Book of historical scientific instruments in the United Kingdom and Eire. At its core is an inventory in which are individually described some 3,700 instruments from collections throughout the British Isles. Astronomical, mathematical, optical and other types of instrument are all covered, as well as philosophical, physical and chemical apparatus, nearly all dating from the period up to the mid– or late 19th century.*

The inventory is preceded by a substantial, illustrated glossary in which more than 50 categories of instrument are described, from Abacus and Air Pump to Waywiser and Wheel–cutting Engine. Over 140 photographs make it of particular value as an aid to identification. A bibliography of some 500 books and papers, two comprehensive indexes and details of the museums, institutions, and collections where the instruments can be

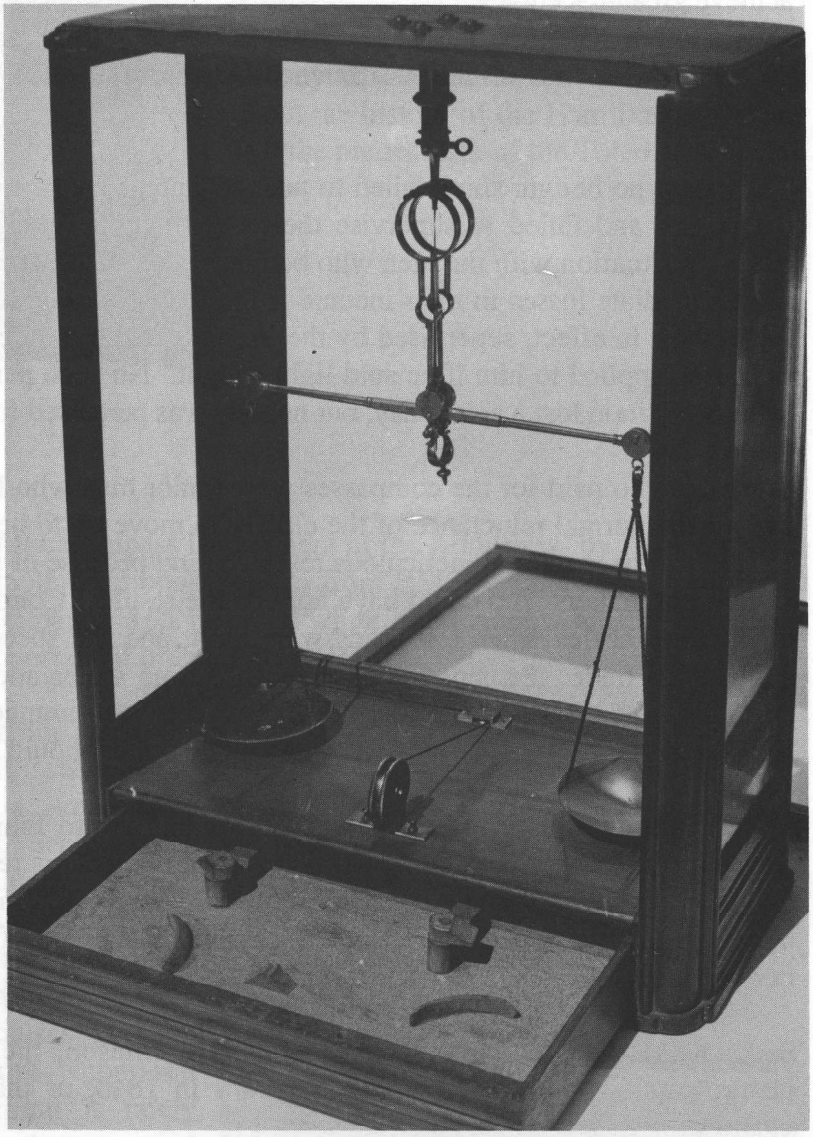


Fig. 1 An example of a balance that could have been included as a scientific instrument, being made by mathematical instrument maker Robert Watson of Newcastle on Tyne, working from 1821 until about 1880. Note the cord and wheels lift, that takes the cord inside the frame and allows a clear view of the pointer from either side.

found make Science Preserved an essential work of reference for collectors, curators, and historians of science."

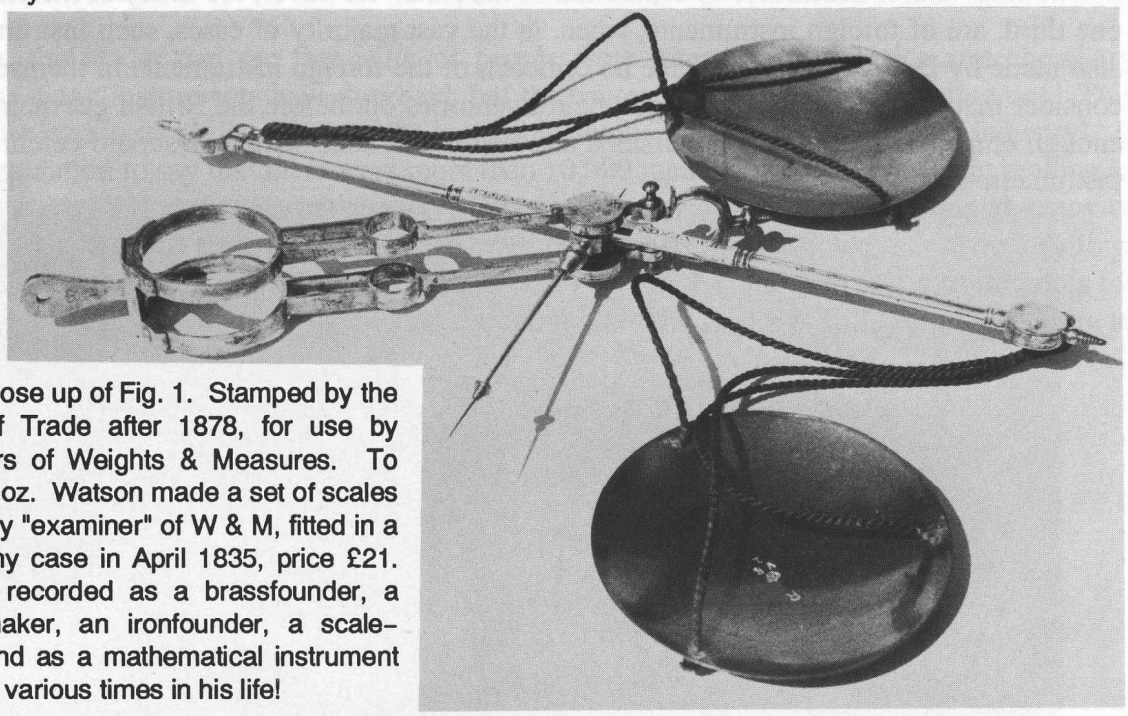


Fig. 2 Close up of Fig. 1. Stamped by the Board of Trade after 1878, for use by Inspectors of Weights & Measures. To weigh ½ oz. Watson made a set of scales for use by "examiner" of W & M, fitted in a mahogany case in April 1835, price £21. He was recorded as a brassfounder, a watch-maker, an ironfounder, a scale-maker and as a mathematical instrument maker at various times in his life!

This is a reference book, not intended as a good read, but I found it interesting. Whenever I started on a specific entry, I was drawn on, reading the next entry and thinking about other examples of the same kind, other instruments made by that maker, or other makers in the same town. An enormous amount can be learned about some manufacturers, and the rarity of the work surviving by other makers is thrown into relief.

The glossary's photographs are superb, showing three dimensions dramatically and high-lighting

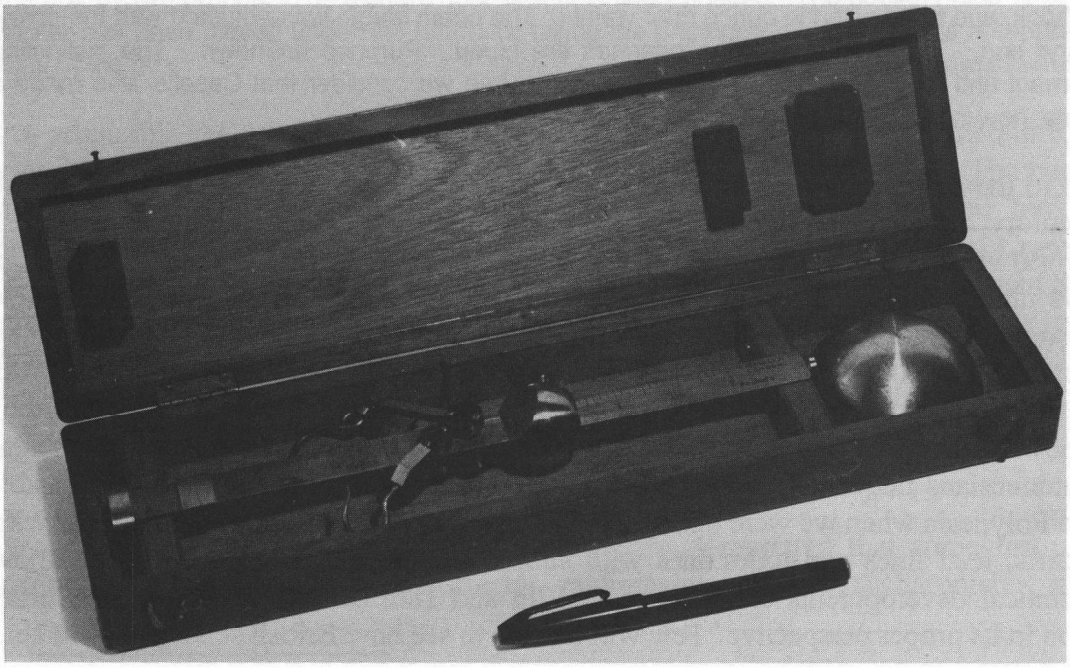


Fig. 3. Made by L Casella of London, working there 1844 until his death in 1897, as mathemat-ical, philo-sophical, , surveying instrument, electrical & galvanic instrument maker. Note the very small hemispherical pan. See Fig. 4 for close up.

the engraved surfaces. The various parts of complicated instruments are shown by careful positioning, and, if necessary, by separation of the parts. However, too many of the photographs, one third, are of foreign instruments, when, in the vast majority of cases, such instruments were also made by British makers. I have no criticism of the foreign instruments in themselves, but I consider that the six countries that got their inventories out before the British got theirs out, give enough emphasis to foreign instruments, and that the British Inventory should celebrate British instrument–making skills.

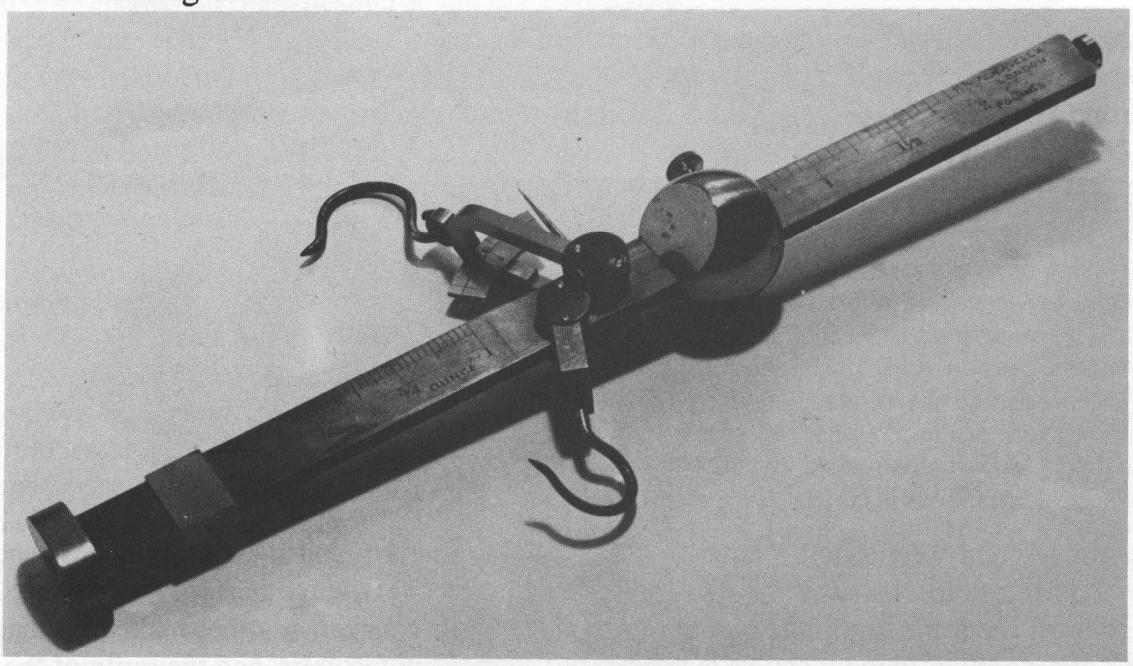


Fig. 4. Close up of Fig. 3. Casella sold this curious steelyard, made of brass, with a small rider weight on the left, weighing up to 1 ounce in 1/48 oz. increments, and a large rider on the right weighing up to two pounds. The larger weight could be fixed in position with the screw on top. A graduated arc behind the pointer allowed accurate readings to be taken. Loads could be fixed to the hook, or the little pan could be hung from the hook, and tared with the ounce rider weight. The beam length was adjusted with the screw at the right hand end. The covers over the bearings are blued. Purpose unknown. The distinction between instrument and tools becomes even more blurred when we consider that Casella also made a fine person scale, now in the Old Jail in Hampton, Virginia, USA.

This leads me to the major omission. The greatly respected men who added to and revised the Holbrook inventory, are men well fitted, in my opinion, to discuss the place of British instrument makers in a world view of instrument making. It is all too easy for the British to assume that we were followers rather than leaders before the late 18th century, knowing that the Arabs knew more about astronomy and mathematics, Arabic libraries were greatly ahead of ours, knowing that our universities developed after the French, knowing that German and Low Countries' brass work was greatly superior to British brass work, knowing that Venetian glass was way ahead of the British, knowing that the Chinese had sensitive seismographical instruments 2,000 years ago, and that the Indonesians frequently launched out across thousands of miles of Pacific to inhabit Melanesia and Polynesia when we were taking our first nervous voyages across the Atlantic with a few back staffs, lead lines and lodestones with simple compasses. Few readers will know enough of technical developments to put the late 17th and 18th century flowering of British instrumentation in its proper perspective. Few will be able to see how British scientists were able

to benefit from the fruitful collaboration between scientists wanting tools to investigate, and instrument makers, with their precise technological skills, willing to make prototypes.

Obliquely, the reader can see that a lot of people were interested in physics and chemistry because so many instruments have survived, but the causes should have been spelled out. This should have lead to some discussion of the incredible number of men working in the industry[1]. It is no exaggeration to say that there were more than 10,000 men engaged in instrument making in Britain between 1550 and 1850, making a phenomenal number of instruments. Granted, many of the instruments were of a prosaic nature, and were the tools of trades such as surveying, sailing, engineering, inspectors of weights and measures (see Fig. 1 & 2,) and lecturing, and the tools for dilettantes with hobbies such as botany and astronomy, but the reader is still left with a desire to know *why* so many instruments were made in Britain.

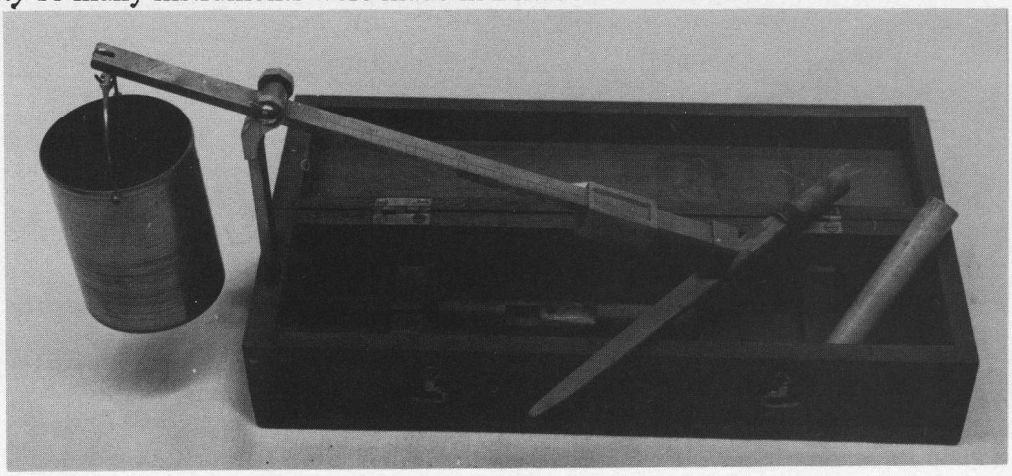


Fig. 5. One of the instruments mentioned in passing in the résumé of the National Museum of Scotland's glories, is this chondrometer by Adie of Edinburgh, working alone after the death of his uncle, John Miller, in 1822, until his son joined him in 1835. This is an example of a marginal scientific instrument that was a tool for a trade. It was made differently from the London chondrometers of the time. The pillar is held into the box by two prongs. The elegant rider weight is finely shaped. The bucket holds ½ pint of grain. The striker has been placed under the beam for taking the photograph. The roller is a separate piece on the right of the box. National Museum of Scotland, inventory number 1965,38.

An admirable feature is the extensive and numerous references to the literature, which shows clearly the superb books becoming available during the last thirty years. The beginner must be awed by the excitement demonstrated by the variety and the focused look at particular instruments. On a personal level, I regret that the publications by Michael Crawforth were not included in the bibliography. I know that his published work was basically about the makers, and not the instruments, but his development of the Project Simon list of British (not London, as stated) makers affected greatly the place given to the notable makers, and Michael's work on scales would have helped the authors if they had read his works. If they could include Shortt on "A Thirteenth Century Steelyard Balance from Huish", then they should have included Crawforth's publications.

Working from the inventory back to the glossary, I regretted that some instruments are not explained, such as the course corrector, eudiometer and the saccharometer, goriometer and

[1] Project Simon has not been published yet, but its findings are broadly known.

hypsometer. If an instrument has been recorded then it should be defined. For example, a hypsometer is either "a form of barometer used to measure altitude" or "an instrument for determining the height of trees", but we don't know which they have at the National Army Museum.

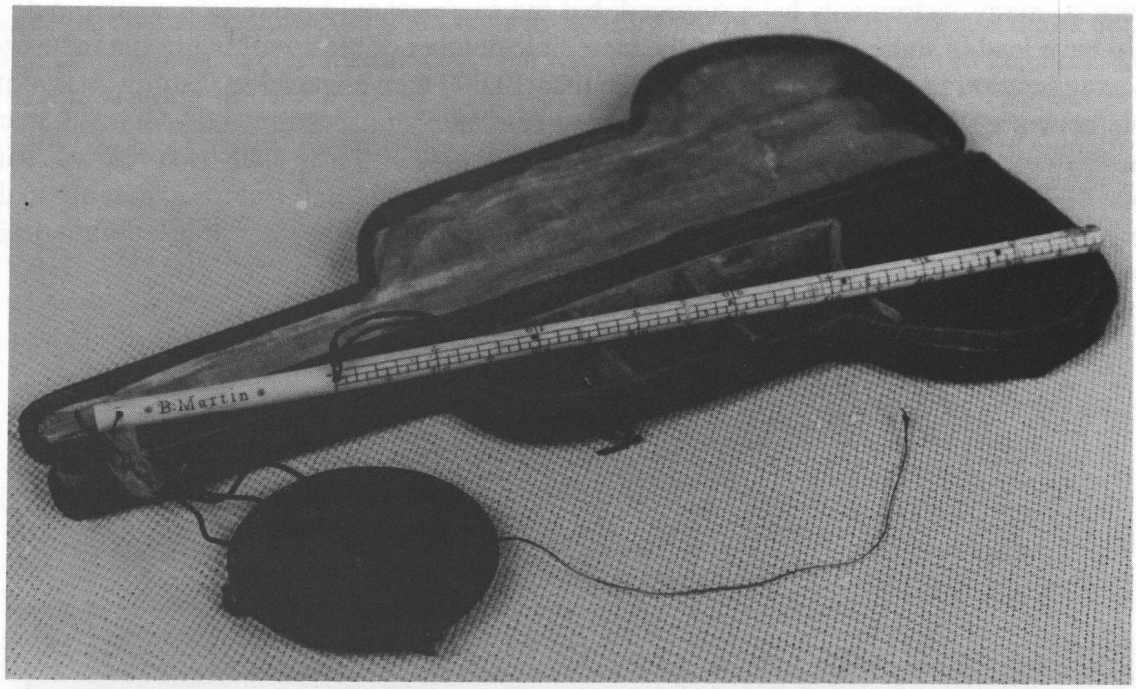


Fig. 6 A dot'chin by Benjamin Martin, showing how closely he followed the design of Chinese dot'chins. Martin had a shop in London from 1744 until 1782, where he sold a huge range of instruments 'off the shelf', a novel way to sell instruments at that time. Martin used two poises to operate with the two sets of graduations, 0–40 shillings on one side, and 0–80 shillings on the other. As the pan has a hole in the centre, we deduce that there was originally a clip below the pan to hold the coin while it was submerged in water for hydrostatical weighing. This necessitated placing water weights in the pan above the clip, to compensate for the degree of floatation of the gold. If the adjustments needed were excessive, the user knew that the coin was adulterated with base metal, usually brass. As so often with hydrostatical coin scales, the water weights are missing. Museum of the History of Science, Oxford.

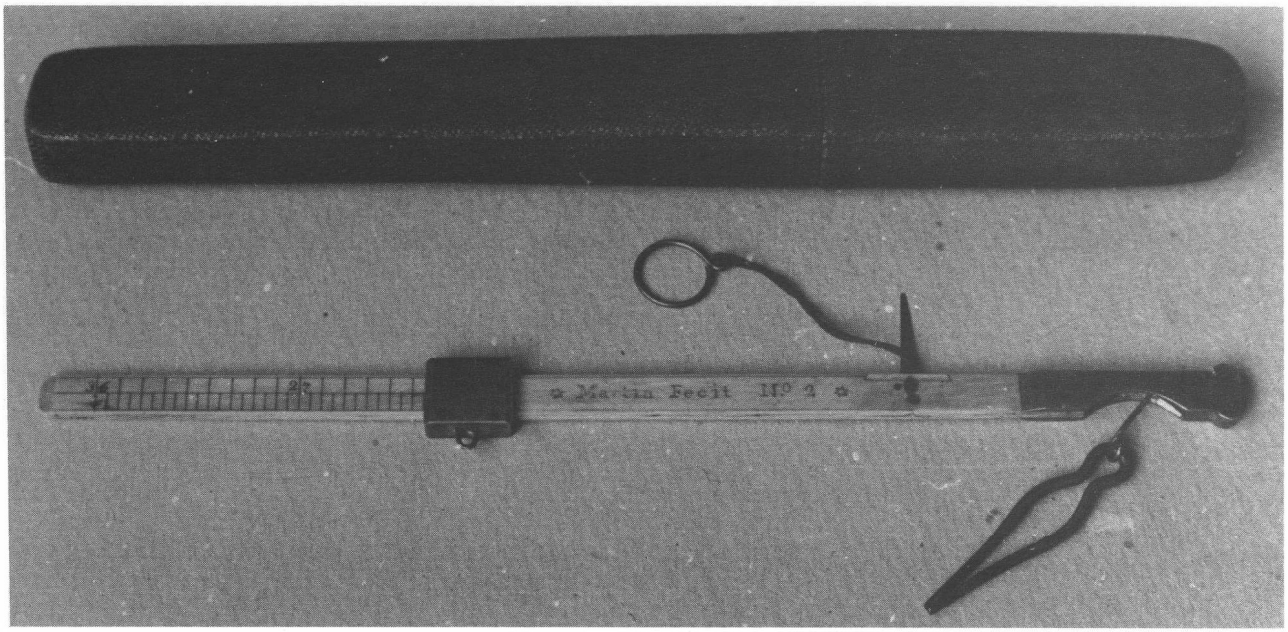
My confidence in the inventory is shaken when instruments are omitted. I would argue for the inclusion of Standards, as definitions of accuracy underlie all experiments, as well as fair dealing in trade. This would mean, at least, a passing mention of the Standards at Winchester, at the Dean and Chapter library in Durham, and at Huntly House in Edinburgh (which are signed John Snart.) Of the instruments considered worthy of inclusion by Holbrook, I see no reason to omit the long beam (20") Oertling balance at the Museum of Science and Industry in Manchester, or the beams made by instrument makers such as John Rowley in the Museum of the History of Science in Oxford. The latter museum had the same problem as other Science Museums, of trying to encompass an embarrassment of riches, but the compilers were endeavouring to publish a list to enable any enquirer to find out where to go to see instruments in which they are interested, and that has not truly been achieved.

The lack of dimensions and museums' inventory numbers must be shaming to the now experienced Mary Holbrook. I know how easy it is to be half way through an onerous job, and to find that one should really start all over again in the light of the experience gained. I do think

that, as it is the only British inventory (as opposed to the Irish inventory, which is a model of condensed information) the 228 museums should each have had their entry returned for notation during the fifteen years that the inventory was lying on various desks. The entries, in all their variety, give an impression of a lack of intellectual rigour.

What must the world think about the British, when their national inventory lay around for 15 years after Mary Holbrook left the project? I was invited to index it in 1984, but I was never given the list in spite of repeated requests (not that I minded, being busy on Project Simon, but it does indicate the lack of urgency felt about its completion.) The Science Museum gave some help towards completing the project, but it is humiliating that the British had to turn to the altruistic Rod and Madge Webster (curators of the Alder Planetarium in Chicago, and members of ISASC) for financial assistance. Have we no means of publishing our national inventory with our own money? Are we such philistines that we will not support our own history of science, of which instrumentation is a part?

Fig. 7 Benjamin Martin progressed from his simple dot'chin to the more precise steelyard with a hinged pointer in1773. A complete discussion of this steelyard is on pages 299–303 of EQM.



So, on to the book as it affects scale collectors. This book is important because it puts scales into the context of one type of user – the scientist and the teacher of science (the philosopher). The book includes only scales used for assaying, specific gravity, chemical weighing, with dot'chins and chondrometers. The inclusion of dot'chins is a mystery, unless one takes as a reason, that Benjamin Martin copied them for his coin scales. (See Figs. 6 & 7.) The inclusion of chondrometers is even more of a mystery, as they were relatively insensitive steelyards used for strictly commercial purposes. They were, in some instances, made by instrument makers, (see Fig. 5) but if chondrometers were included, why were the special scales, (see Figs. 1 – 4,) made by instrument makers excluded?

The glossary entry on balances looks very odd to us, because the technical development is seen only in terms of scientific instrument makers' innovations, with no acknowledgement of the traditional scalemakers' skills. John Snart, Samuel Read, and DeGrave Short & Fanner are ignored. A great point is made of Jesse Ramsden's double cone beam (a very impractical object to manufacture), and the hundreds of practical and sensitive beams ignored.

There is little concern with weighing as a valuable tool in the scientist's understanding of his materials and his experiments. Mention is made of beam rigidity, the rider weight, agate bearings, beam length and loading the weights from outside the case, but there is no discussion of the variety of solutions, – no substitution weighing, no damping, no arrestments, no other resistants than weights, no units of mass, no handling methods. In fact, one would think that were few problems associated with scales – no corrosion, no heat affecting beam length, no wear on the pivots, no difficulty in reading the graduated scale.

Our members will be amused to see "sovereign balance" in the Aberdeen inventory, but, on turning to the illustration, will find a Hooper's postal bismar of 1839 clamped onto a W & S Jones lever–demonstrating apparatus. And what is a "Counterpoise balance. Brass, weighing up to 16 oz. Signed G. Booth, Aberdeen 1844"? Holbrook should have given a better description.

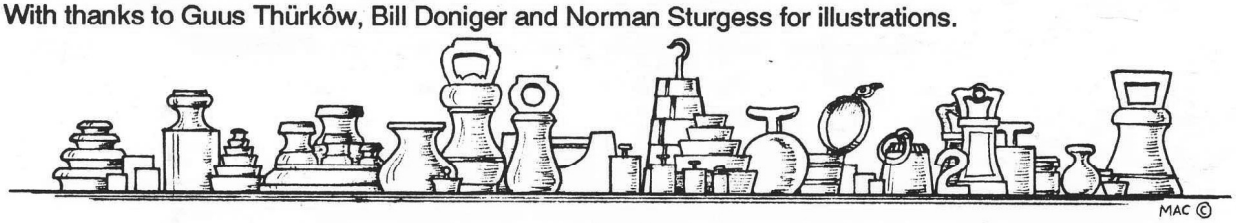
It is exciting to discover scales in unexpected places, such as the Merlin person–weighing scale at Bolling Hall in Bradford, the Crichton glass–cased balance at the McLean Museum in Greenock, and the Coulomb torsion balance, signed Pixii, at Glasgow University. Those will have to be visited. Have our members been to Worthing, to the Tolson Museum in Huddersfield, or the Gentleman's Society Museum at Spalding?

In parenthesis, how many of us could be painted in as favourable a light as the epicure on the cover? There he stands, thinking seriously, with his stomach full of good food, his body attired in satins, velvets and gold braiding, and behind him, his books open for reference, while he leans nonchalantly on a table. The table has a beautiful Wright and Wyeth orrery on it, and the shelves behind are crammed with instruments for scientific investigation. But then, he had servants to give him the time to enjoy his learning and his research!

To conclude, this is a patchy, half–finished job being presented as the "Domesday Book of historical scientific instruments"! Well perhaps it is. The Domesday book is erratic, has many errors and omissions, and is, in parts, impossible to comprehend because the authors made assumptions about the knowledge of their readers that no longer apply. Will the same be said about "Science Preserved"?

Being the only list available at present, it will be used, but it would be hard to justify spending £35 on it, until it contains more basic information about each instrument. D F C–H

With thanks to Guus Thürkôw, Bill Doniger and Norman Sturgess for illustrations.



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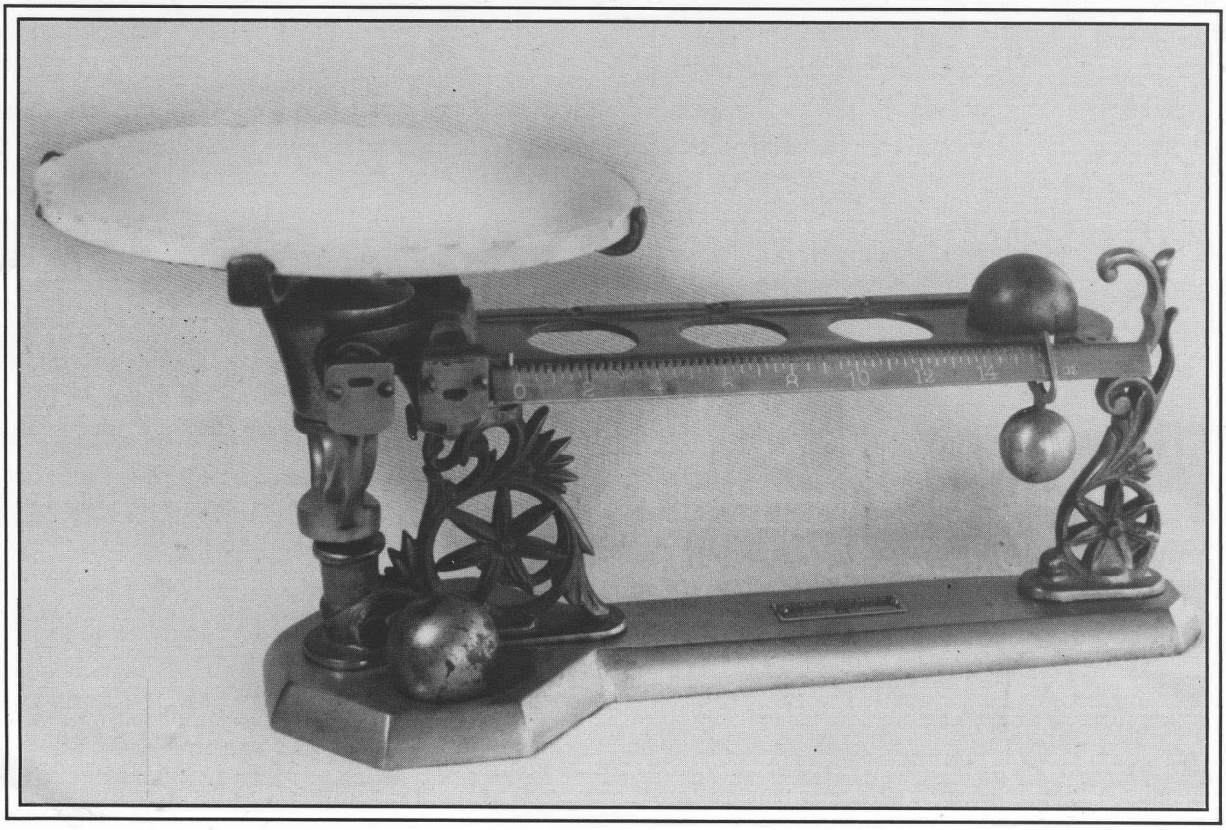
EQUILIBRIUM®

QUARTERLY MAGAZINE OF THE INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

1993—ISSUE NO. 4

PAGES 1721-1748



Corrections

p1722 line 17 should be *pages 1730 to 1739.* p1723 line 15 resign should be *design.* p1742 line 34 should be *page 1727.* p1744 line 20 it was should be *was it.* line 21 she was should be *was she.* line 24 worked should be *work.* p1747 line 30 should be *page 1741.*

Cover Picture

The whole of this issue is devoted to English trade scales, but none were ever made which can compare with American ball scales. This one is a 20th century version by Henry Troemner, which has a spare ball. The four hole version was sold with one ball, which balanced 1 lb. in the first hole, 2 lb. in the second, etc., and the little ball on the front beam indicated the ounces up to 1 lb. – so the capacity was 5 lb.

F. Schmerl collection.

N & Q 125 from A J HERBERT

Please can you give me any information that you have in your Scale–makers Index or other records, that will help me to compile a history of my company, Herbert & Sons Ltd? Some of the material that I already have is laid out in my article 'Herbert's, the Tale of a Lion', in EQM, pages 1191 to 1202.

Reply from the editor

I set about drawing up a "Trade Tree" for Herbert's, so that all your trade connections could be seen at a glance. Imagine my dismay as the tree grew branch after branch, all ultimately connected with your company by training or by trade succession. The final tree is far too big to be seen 'at a glance', but it forms such an important body of knowledge about London scale–makers, that I have wrestled with the problems of publishing it in EQM, pages 1729 to 1738. I recommend that you take EQM to a photocopy shop, and get each page of the chart enlarged, then stick the pages together, (omitting the overlaps,) to reconstruct the original large chart, and stick the chart to the wall while you examine it, and while you read the comments below.

INTERNATIONAL SOCIETY OF ANTIQUE SCALE COLLECTORS

Founded September, 1976

176 West Adams St. • Suite 1706 • Chicago, IL 60603 • Phone 312/263-7500

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Herbert's, Part 2

BY D F CRAWFORTH-HITCHINS

During the compilation, some points became apparent, about the individuals, about the trade and about the limitations of the chart.

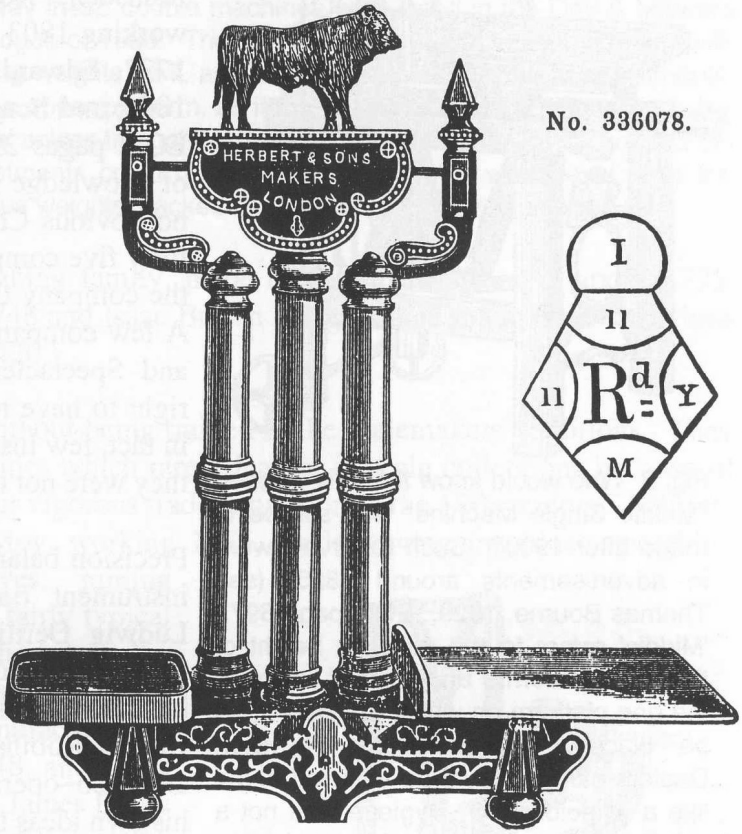


Fig. 1 Jim Herbert very generously gave permission to publish the bulk of their earliest catalogue, thought to be about 1879. However, on examination, this page, with its design registration number as well as the diamond registration mark, made it clear that this catalogue was published after the number was awarded in 1900. Of such small clues much research is confounded or adjusted. In this case it makes the whole catalogue more interesting, because so many of the designs are of early types, that Herbert & Sons obviously still found competitive and in demand.

If the scalemaker was not connected with the Herbert's, he was not included, however important he was. Of numerous examples, a few names will demonstrate the point. Christopher Walton, 1789–93; Edward Ambler, 1694; William Sutton, 1799, Robert Toulmin, 1768 to 1775; Thomas Burnett, 1789 to 1804; Joseph Jones, 1775 to 1789 and John Dunn, 1805, all had to be omitted.

Because Herbert's were trade scalemakers, their connections tended to be with other trade scalemakers, who trained as plain makers of *'Scales, Weights and Steelyards'*. This point has to be emphasised, as there were many makers of scales who trained in other traditions, as discussed in the next fivepages.

Some coin scales were made by entrepreneurs, who invented their own idiosyncratic little coin checkers, such as Solomon Henry in 1774 in collaboration with Thomas Warner (see EQM pages 263 and 271); William Lund in 1839; William Cotton in 1844 in collaboration with R B Bate; Edmund Heeley in 1842 and John Sheldon in 1842, (see EQM page 446.) They had no trade links with "proper" scalemakers.

Other makers who did not have any trade links with the trade scalemakers were the postal scalemakers, a few of whom worked in London. John Sheldon and William Lund have already been referred to, but there were other successful businesses supplying stationers' sundries and manufacturing their own scales, such as George Riddle between 1839 and 1847; (see EQM page 112,) Sampson Mordan & Co from 1839 until 1941 (see EQM pages 933–950,) and Marion & Co from 1845 to 1920.

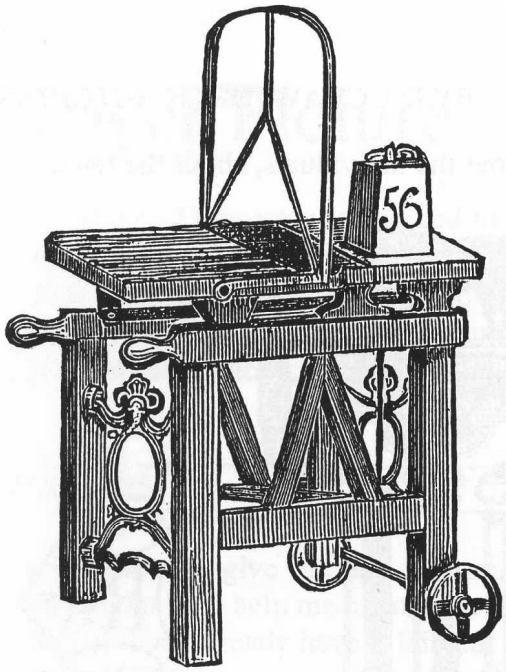


Fig. 2 Who would know that this wooden "Middle Single Machine" was still being made after 1900? Such robervals were in advertisements around 1825, (see Thomas Bourne, 1829, EQM page 697.) 'Middle' refers to the middling height of the load platforms and 'Single' refers to the one platform on which the load could be placed. "Suitable for Provision Dealers etc." It could be wheeled about like a wheelbarrow. Hygiene was not a priority when the food was in sacks!

The instrument-makers made scales so that they could supply a comprehensive range to philosophers, chemists and scientifically-minded gentlemen. Famous names include George Graham, working 1713 to 1751; Jesse Ramsden, working 1763 to 1800; Thomas Jones, working 1803 to 1852; John Rowley, working 1690 to 1727; Edward Nairne, working 1752 until he died in 1806; and Benjamin Martin, working 1736 to 1782 (see EQM pages 299-303.) Instrument makers had chains of knowledge in the same way as scalemakers, but had no obvious Company to join and have been found in forty five companies, including Blacksmiths' Company, the company that enrolled the majority of scalemakers. A few companies, (Blacksmiths, Clockmakers, Grocers and Spectaclemakers,) considered that they had the right to have responsibility for instrument makers, but, in fact, few instrument makers were in Blacksmiths, and they were not trained by scalemakers.

Precision balances were made by men in the scientific instrument trade, but who specialised in balances. Ludwig Oertling worked in Berlin until 1847, then came to London to set up an expanding and successful business taken over by Avery's in 1925. Thomas Charles Robinson, working from 1823 until his death in 1841, co-operated with Kater then went on to develop his own ideas for refined laboratory balances.

Foreigners came to London and met problems with the Companies. They had to join a Company as an Alien Brother if they wished to work within the City, by paying a large fee, until the Statute of Artificers was rescinded in 1814. After that, they just had to cope with the normal fierce competition of the Capital. Although some of them were trained as scalemakers in their country of origin, they had no links with Herbert's and consequently do not appear on the chart. Anscheutz & Schlaff were merchants between 1772 and 1781, (see EQM pages 269, 597 & 607,) making Johann Sebastian Clais' patent coin scale of 1772; Johann Wilhelm Herbertz came from Solingen to London in about 1763 and worked until 1779 making coin scales; Hurter & Haas made precision balances until Haas went to Portugal in 1795; David Koritschoner made glass-cased diamond balances between 1888 and 1905; Levy Levy, of unknown antecedents, was in trade Directories between 1832 and 1841; and the ebullient Belgian, John Joseph Merlin, came here in 1760 and enchanted Londoners until his death in 1803.

John Joseph Merlin made watches and clocks, as well as his tiny coin steelyards and handsome mahogany person scales. Watchmakers were another exclusive category of scalemaker that did not overlap with the proper scalemakers. Matthew Hill, maker of another coin steelyard, worked from 1744 until 1790 (see EQM page 270.) William Frodsham, working between 1760 and 1804, was one of the illustrious Frodsham family of watchmakers, but he found time to design and make little coin scales with a beam with two hinges that allowed it to fold into a tiny box.

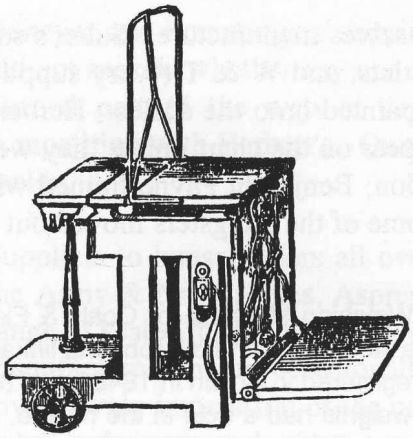


Fig. 3 "Double Weighing Machine," so called because there were two positions on which to place the load, high up or low down. Note the iron handles hanging down the side of the frame, out of the way of the loader, that could be pulled up horizontally for use. Again, a design from the 1820s. An interesting light is thrown on the way these double machines were used in the Day & Millward catalogue of 1889. Theirs showed the lower weight platform with the big weights on it, and the little weights, for minor adjustments, on the upper platform, as if the big weights were left down by the users' ankles throughout the weighing of a series of sacks, and the adjustments could be comfortably made at waist level, with the surplus weights stacked on the stationary central section.

Chisman, one of the Chisman watchmaking family, made elegant coin scales in about 1775, William Edley made coin scales from 1748 and Isaac Brown designed and made three variations of coin scale, (see EQM pages 1413 to 1420.)

Machinists and engineers made scales without being trained in the scalemakers' traditions. They made rugged, utilitarian weighing machines which rarely feature in scale collections because of their great size, but helped to maintain our vigorous trade expansion in the 19th century. William Jackson, working 1873, and Thomas Moy, working 1875, made sewing machines, weighing machines, steam engines, locomotives, mining machinery and fire engines. This list is fairly typical of the heavy end of the market, although each maker had a slightly different range of products. Henry Marriott was an ironmonger and manufacturer of stoves and baths between 1812 and 1848, and made leaf–spring balances in dial–front cases. James Braby made wheels and springs for carriages between 1816 and 1837, and invented an open, flat spring scale for kitchen use, or for weighing up to one hundredweight.

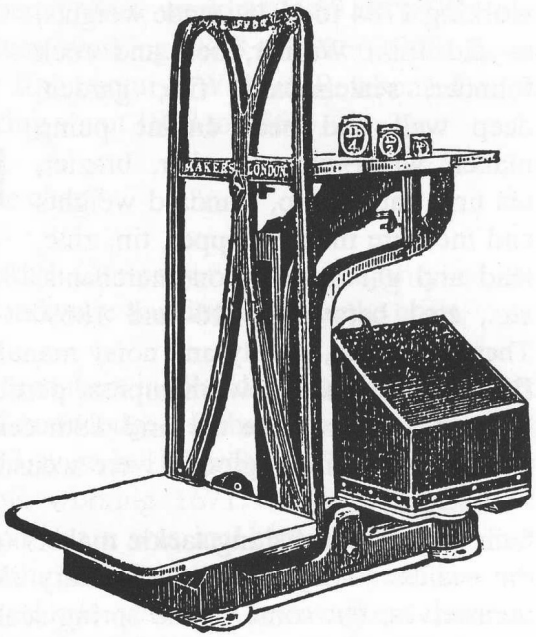


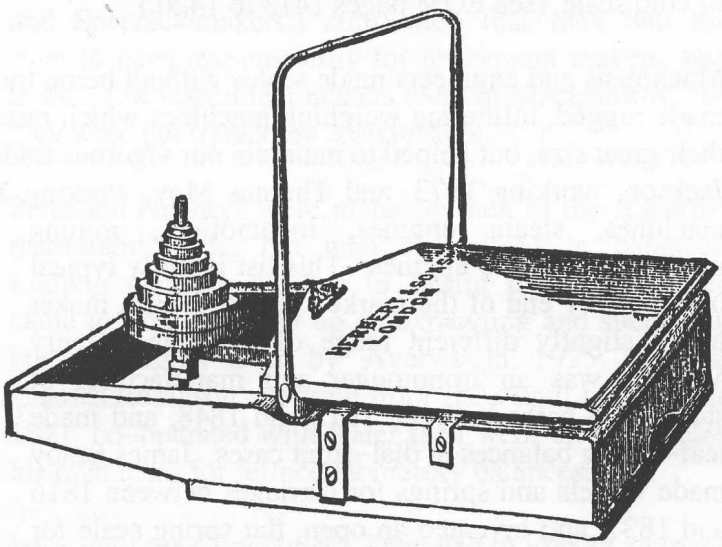
Fig. 4 "Improved Patent Curvilinear Coal Weighing Machine," of slightly more modern design, with its iron frame. The curvilinear design was used, in a modified form, by Avery's by 1850. No handles or wheels, so not mobile. Note the box, which appears to be part of the moving mechanism. With reference to the comment with Fig. 3, did the user place in the box only those weights that nearly balanced the load, so that he reduced the risk of error?

Trade Directories inadvertently gave the impression that some important makers worked in London but this was misleading, because the Directory merely recorded that company had an Office in London. Naturally, a group of office workers and administrators had no connections with Herbert's. Henry Pooley of Liverpool, Charles Hartner of Ebingen in Germany, A von der Nahmer of Remscheid in Germany, Fairbanks of St. Johnsbury in America, William Tabberer, R W Winfield and W & T Avery of Birmingham were some of the dozens who found it advantageous to have an office in the capital.

Provincial makers were very much involved with trade in London, supplying London makers with

particular types of scales that the London makers did not themselves manufacture. Salter's sold vast quantities of spring balances in London through retail outlets, and W & T Avery supplied other makers with scales with the other maker's name cast or painted onto the scales. Herbert's had the competition, but their provincial competitors do not appear on the chart unless they were trained in London. Some of the Bartletts were trained in London; Benjamin Payne trained with William Astill before he set up a branch in Birmingham; and some of the Sangsters moved out of London to the South-west, and thus appear on the chart.

Fig. 5 "Improved Lever Weighing Machine for Coals & Field Use." 'Lever' refers to the steelyard with half-roberval linkage under the load platform, registered in Britain in 1848 by W & T Avery. The proportional weights had a hole in the middle, so that they could be accurately located on the spike. A very similar scale was made by Day & Millward in 1889, which they recommend for **baskets** of coal or vegetables.



Coppersmiths and founders normally worked out of the public eye, (as did Joseph Glaister, scale beam forger between 1805 and 1822, Thomas Saunders, forging scale beams in 1807, and small scale beam filer Samuel Roberts, working in 1888,) supplying other tradesmen with their basic castings and parts, but occasionally coppersmiths and founders made complete objects for the retail market. Jonathan Haskins, working 1784 to 1838, made weights, as did John Warner, bell and cock founder, scalemakers, fire, garden, deep well and beer engine pump maker, water-closet maker, brazier, tea urn, bath, lamp, standard weights and measure maker, copper, tin, zinc, lead and galvanised iron merchants, etc., etc., between 1816 and 1869. These vigorous, smelly and noisy manufacturing processes were more commonly carried out in Birmingham and Wolverhampton, particularly in the 19th century, but the Warner family had been in London since the mid-18th century at least, and had built up a thriving business, so presumably their neighbours were accustomed to them!

Gun makers and fishing tackle makers offered scales to their customers, and had their name on the scales. They had the necessary skills and manufacturing processes to make the scales themselves, but some of the spring scales look like Siebe's quality. Theophilus Murcott was working in the Haymarket between 1865 and 1878, and sold long thin, tubular spring balances with his own name on them, as did Charles Farlow & Co.

This group leads to a large category of Suppliers, such as grocers' suppliers, Savage & Co and Gilbert, Ames & Co; apothecaries' suppliers such as John Piggott and Maw, Son & Mawson; tea merchants' suppliers like H G Planner & Co; egg producers' suppliers like C A Sydenham Hannaford and Eltex; tool & cutlery suppliers like Edward Preston; butchers' suppliers like William Douglas & Sons; scientific instrument suppliers like Brady & Martin and James Wooley Sons & Co Ltd; textile trade suppliers like Goodbrand & Co Ltd and Henry Lord; farmers' suppliers like Jacem; shop fitters like Pike & Ellerman; surgical appliance suppliers like

Baileys; and ironmongers' suppliers like G B Thompson & Co. The catalogues of these suppliers did not specify whether any one item was made 'in house' or bought in from a specialist, but they formed part of the web of suppliers of scales, and formed an integral part of trade and competition with Herbert's. Quite possibly they employed trained scalemakers to make or repair scales.

Suppliers to householders all over the country, but with shops in London, like Moorhouse Ltd, the Army & Navy Stores, Asprey's, Gamages and Harrods were in a similar position, offering a range of scales for the home, in various qualities, with their name on sometimes, or with the real manufacturer's name occasionally. Catalogues have survived from the stores mentioned, and give a lively impression of the competition that Herbert's had to contend with, in kitchen, postal, baby, and person scale sales.

Chondrometers (grain scales) were made by a specialised group, very few of whom trained as scalemakers. Scalemakers who made chondrometers did have connections with Herbert's, companies like DeGrave, Short & Fanner, working 1845 to 1871; Dring & Fage, working 1793 to 1894; Benjamin Payne working 1829 to 1850; and Young & Son, working 1811 to 1901. However, most chondrometers were made by about twenty scientific instrument makers with no connections with Herbert's, makers like Joseph Hicks I, working 1817 to 1822; W Langley, working in 1875; Joseph Long, working 1830 to 1880; A Griffiths, working 1776; Alexander McKenzie, working 1816 to about 1860; William Robert Loftus, working 1859 to 1899; John Bleuler, working 1757 to 1829; Thomas Odempsey Buss, working 1863 till after 1900; Bryan Corcoran and his descendants, working 1812 until the 20th century; William Rawbonn Dell & Son, working in 1880; and Charles Wastell Dixey, working about 1838 to 1860.

After all these excluded groups, who ***was*** included on the chart?

The predecessors of the Herbert's were in Blacksmiths' Company, so the majority of the scalemakers in Blacksmiths' had some links with them, and were thus included on the chart.

The makers in other companies who had close links with makers in Blacksmiths, and exchanged apprentices with them, were part of the same chain of knowledge. Robert Vincent I, working before 1736, and John Blackburn, working 1791 to 1833, were in Haberdashers' Company, John Deane, working 1671 to 1698, in Cutlers', Joseph Hearn was in Leathersellers' in 1818, William Bassingham was in Drapers' in 1818, John Harris was in Clothworkers' between 1690 and 1699 and George Sewell was in Skinners' Company between 1763 and 1801, but they had a lot to do with masters in Blacksmiths', and appear on the chart.

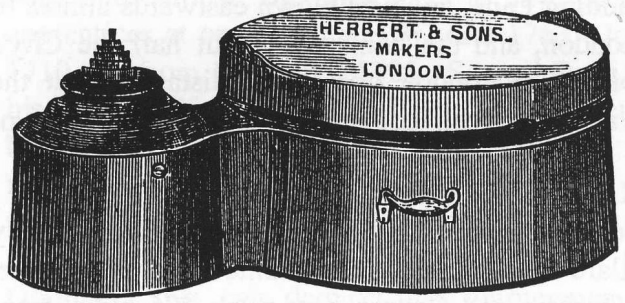


Fig. 6 "Improved machine. Specially constructed for weighing sacks of coal." A much more modern design, but without any frame against which the sack could rest. Did many sacks spread their contents over the feet of the user? Was it common to sell coal by the basket? Note the carrying handles.

An example of a scalemaker trained by a member of Blacksmiths' was Francis Gray, who was bound to Thomas Harrison in 1758, but took his Freedom in Skinners' Company because his father, a coachman, was a member

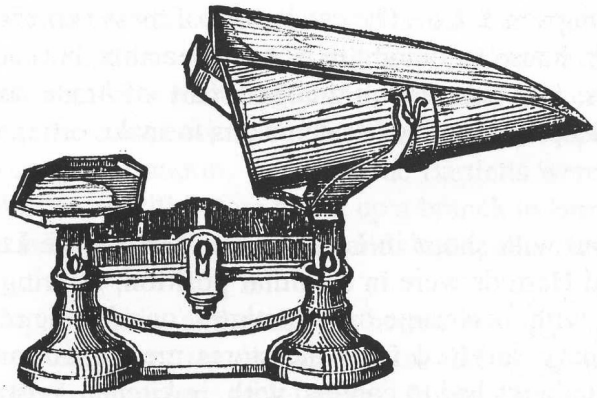


Fig. 7 "Counter Weighing Machine with tin flour scoop." The primitive illustration puts the original date of this printer's block well back in the century. London design robervals, (with the 'bridge' over the centre,) started at the beginning of the 19th century. A rim round the edge of the weight plate was a later development, maybe about 1850?

of Skinners', and consequently, Francis Gray took apprentices in Skinners' Company and in Blacksmiths' Company. Thomas Gable, (son of Thomas Gable, a Fellowship Porter and member of Weavers' Company,) was trained by John Joy, a member of Blacksmiths', but took his freedom by patrimony in Weavers' in 1739.

Thomas Calcott was a member of Leathersellers, working between 1683 and 1701. He took five apprentices, each one formally bound to the Upper Beadle of Blacksmiths' Company, and turned over on the same day to Thomas Calcott to be trained for seven years. Each apprentice then took his freedom in Blacksmiths' Company.

Some of the earliest scalemakers are not included, because Blacksmiths' Company records of the early 17th century (and the records of most other companies,) have not survived, and because some companies only came into existence at the beginning of the 17th century. We know of early scalemakers from other sources, but know nothing of their training and nothing of their successors, For example, Thomas Targot was known to have worked between 1303 and 1312 as an auncel maker, Sir Thomas Aylesbury was authorised to make weights and counterpoises in 1632 and Michael Bayley was a scalemaker in Bartholomew Lane in 1674.

Just as limited is our knowledge of makers like Charles Wombwell, freed in Blacksmiths' in 1643, having successfully made his apprentice piece, (called by his contemporaries a 'proof piece' or 'PP',) a *'gold waight deam'* [sic]. He does not appear to have taken any apprentices, unless he delayed until his forties or fifties, when records were so inadequate in Blacksmiths' Company. [For those unfamiliar with English history, we had the turmoil of a Civil War between 1649 and 1660, followed by several waves of plague, culminating in a vicious, decimating attack of plague in 1665, during which many people fled from London. The next year, the fire in a bread oven got out of control, burned down all the houses in Pudding Lane, and was blown eastwards almost to the Tower of London, destroying a third of London, and the homes of about half the City's inhabitants. By 1680, apprentices were trooping into London from great distances, but the numbers of migrants reduced greatly by 1700, and after that, London supplied the majority of boys needed for apprenticeship.]

Some of the best scalemakers came from considerable distances to train in London, Henry Oxley came 170 miles from Somerset, Thomas Pollard and Samuel Read came 100 miles from Worcester, Joseph Lind came 250 miles from Durham and George Key came 275 miles from Northumberland. We must admire the courage of fourteen year olds, being confident enough to go from little towns (which we would classify as villages now,) to a huge City where they spoke very differently and behaved differently, being surrounded by people they did not know. They promised to obey a man they knew nothing about, unless a rumour had reached their home village as to the quality of their future master, from some earlier apprentice. [In parenthesis,

when I went that distance from my home, to teach, I was unable to understand what the children said for the first three months, when I went to Norwich, when we went to St. Andrews and particularly when we went to Sunderland. Imagine how much more difficult it must have been 200 years ago, when boys had only heard people from their own vicinity.] Obviously the great majority, 62%, of the boys were from London and had fewer problems in settling in, but all had to accept the new regime and the strict discipline of the master's household.

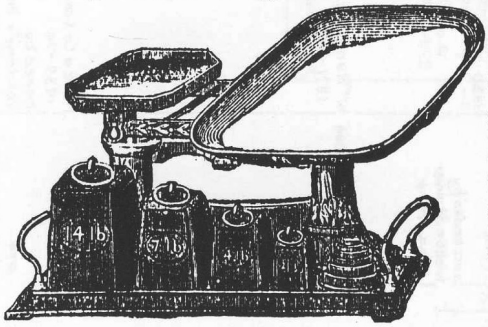
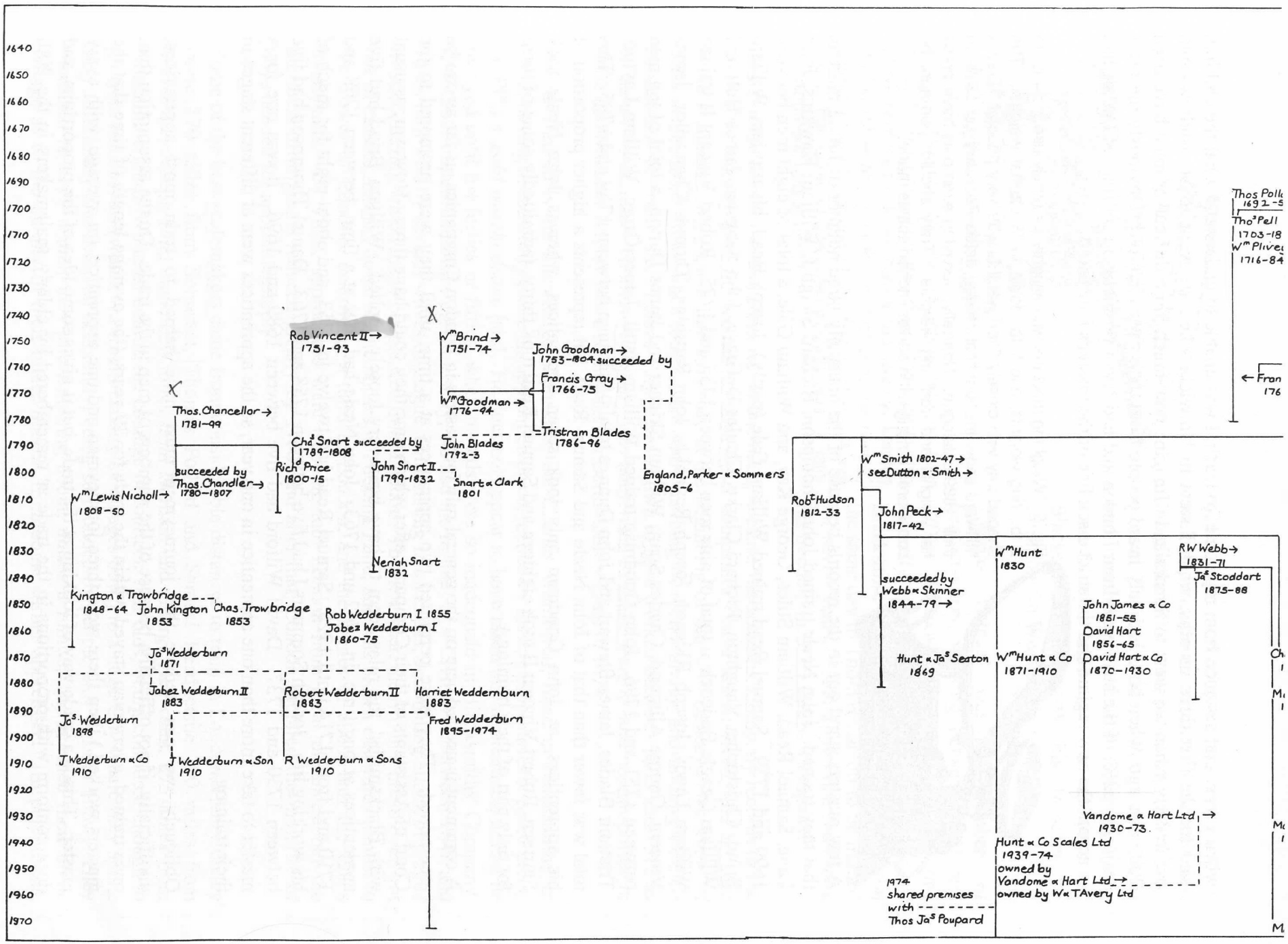


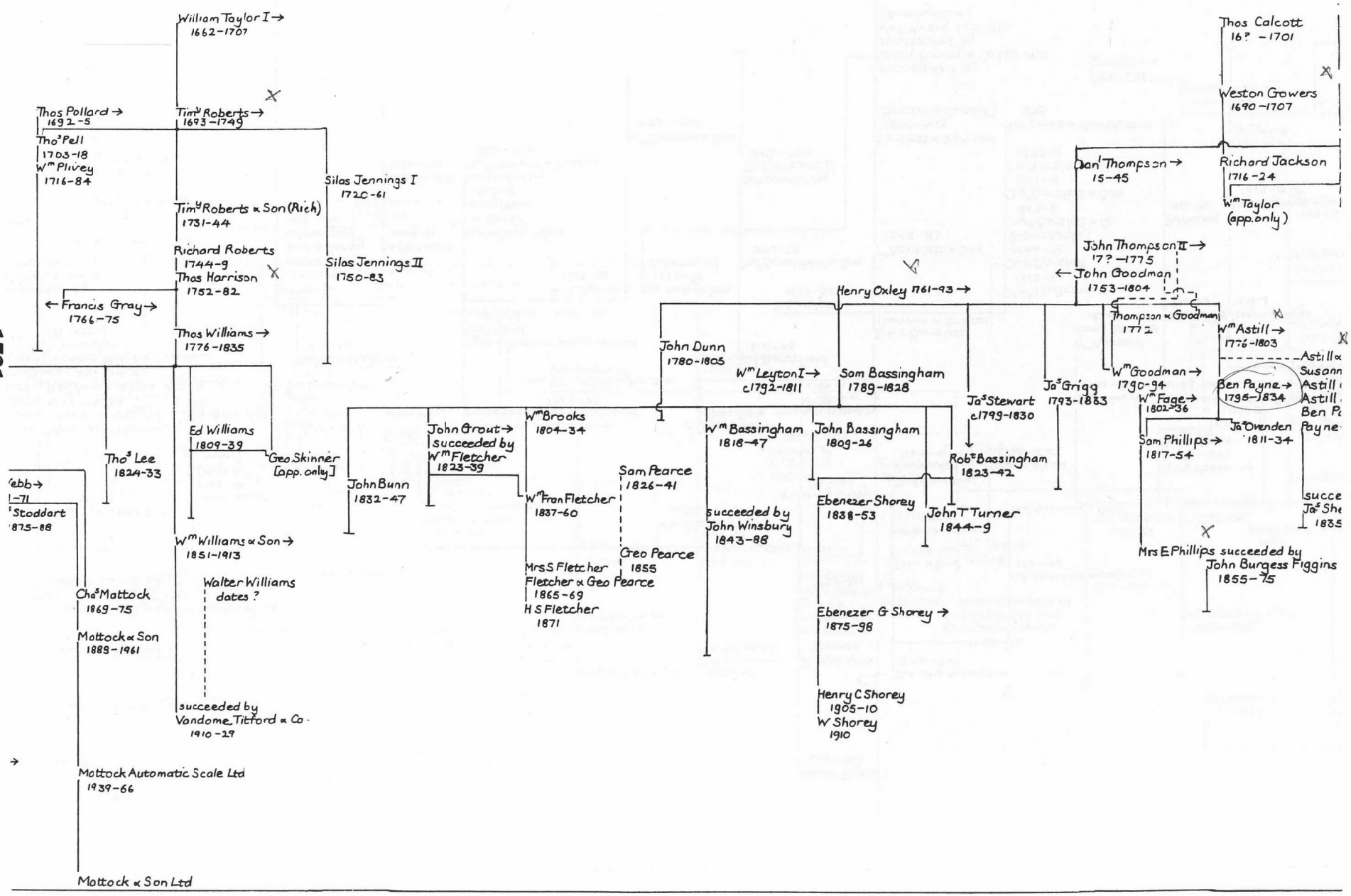
Fig. 8 "Weighing machine with weights for family use." 14 lb. to 2 lb., ring weights, and 1 lb. down to ½ oz, flat weights. The shaped tray with closely fitted weights was very popular. Day & Millward show the identical model, dated February 1st 1874, in their 1889 catalogue. Normally, surviving examples have brass flat weights and iron ring weights. They should, perhaps, be considered amongst the earlier kitchen scales made.

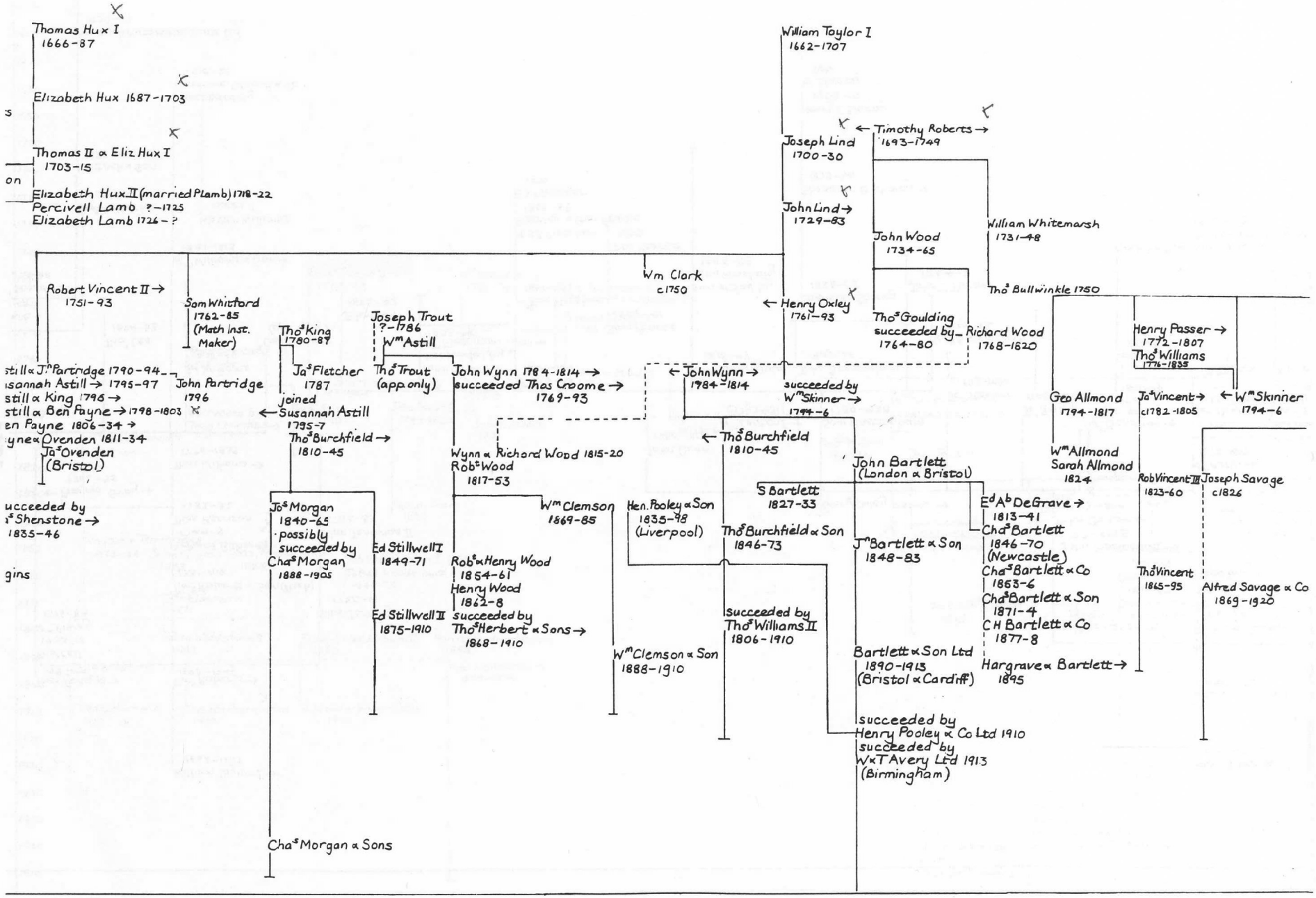
A few masters stand out in the records because of the unusually large number of future masters that they trained. John Neale trained John Thompson, Richard Sleigh I, William Hawkins, John Lane, Samuel Read, William Stiles, George Key, and William Gale, a total of eight men between 1699 and 1739. Samuel Read trained William Gale (partly), Joseph Read, his brother, William Brind, Christopher Vaughton, Richard Clarke, Charles DeGrave, John Sangster, James Holt and William Geagle Badcock, a total of nine men between 1735 and 1775. Robert Vincent II trained William Lewis, Joseph Ridgard, Joseph Reynolds, John Partridge, Thomas Chancellor, James Vincent, George Allmond, Charles Snart, William Skinner and James Dutton, a total of ten men between 1751 and 1796. John Goodman trained William Astill, James Grigg, William Layton, Tristram Blades, James Stewart and John Dunn, a total of six men between 1769 and 1795. This total was fewer than that of John Neale and Samuel Read, but represents a higher proportion of his apprentices, as John Goodman only took seven apprentices, whereas John Neale took fourteen, Robert Vincent II took eighteen and Samuel Read took thirty, (admittedly some of them for only part of their training.)

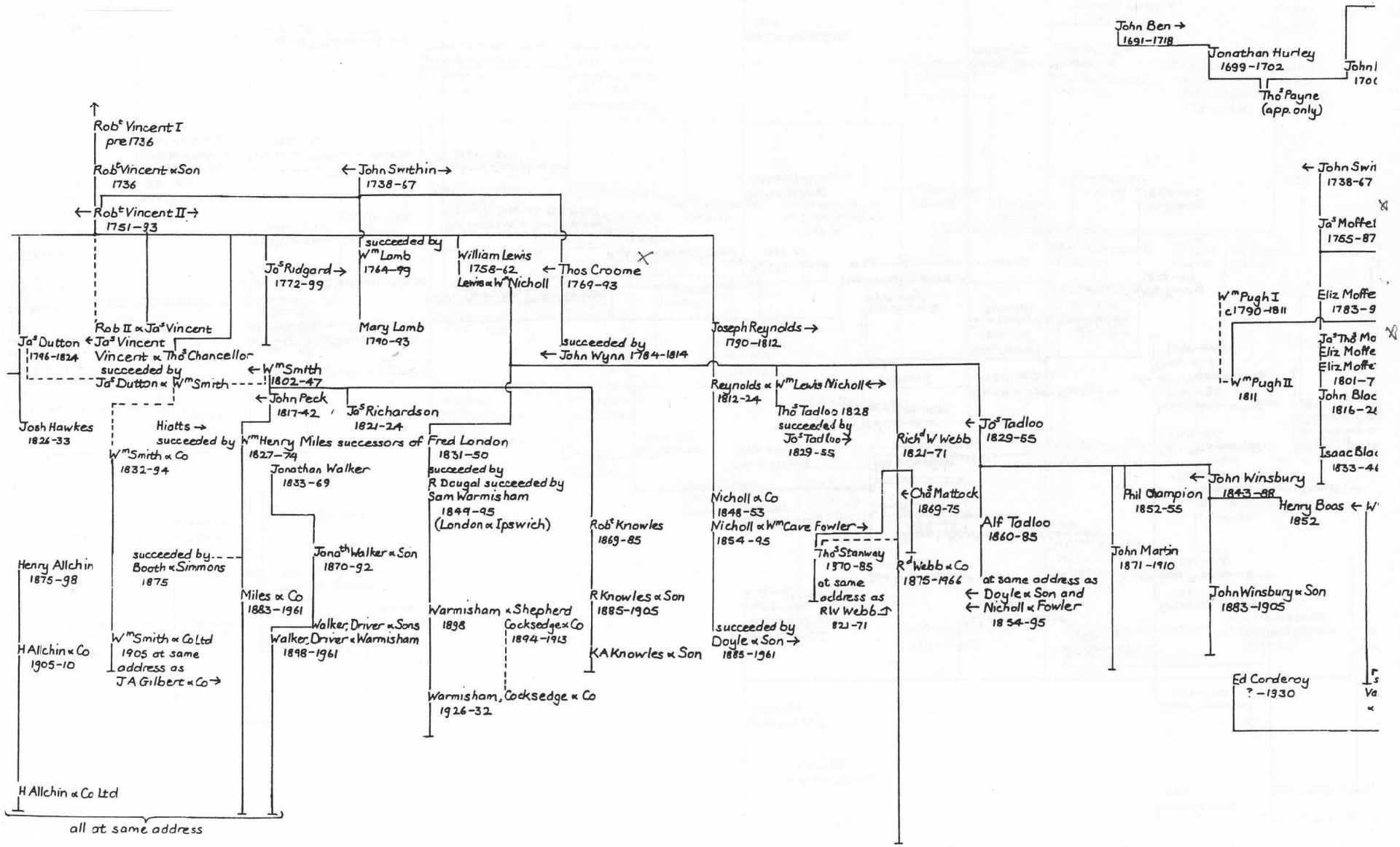
A comment is needed here on the general rule for masters in London Companies, as far as can be ascertained. They were permitted two apprentices at a time, until they were promoted to the Court of Assistants of their Company, after which time they could have three. However, as usual with Blacksmiths', the rules seem to have been very loosely applied. William Brind had five apprentices at one time, in 1762 and 1763. John Neale had four at a time, between 1708 and 1710 and from 1714 until 1725. Samuel Read had twelve in 1763, and about eight for much of his working life. Joseph Sommers I had five between 1758 and 1763. Daniel Thompson had five between 1730 and 1737. David Wilford had five between 1689 and 1696. It was rare for a master to take more than one apprentice in one year, so the apprentices were at different stages in their training.

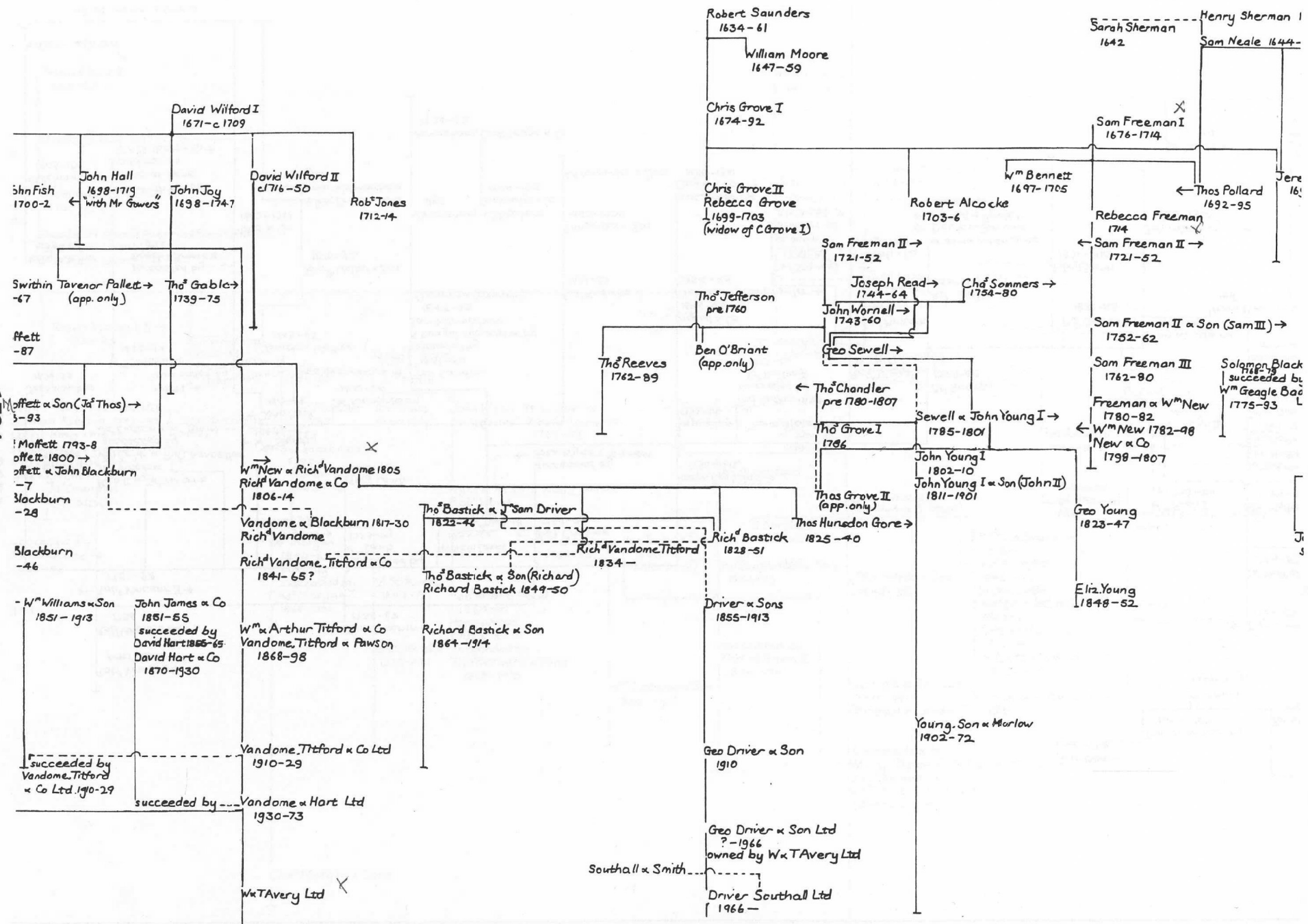
Obliquely, we can deduce that journeymen must have helped to train most apprentices, unofficially, if not officially, because of the numbers of men in the trade. On the assumption that, once trained, every man stayed within the trade for 39 years, (the average length of time that the masters worked,) then there were three journeymen and one apprentice, on average, with every master. This is a crude way of looking at the trade, but it gives some idea of the proportions, and does conform with proportions in the trade as remembered by elderly scalemakers in the 20th

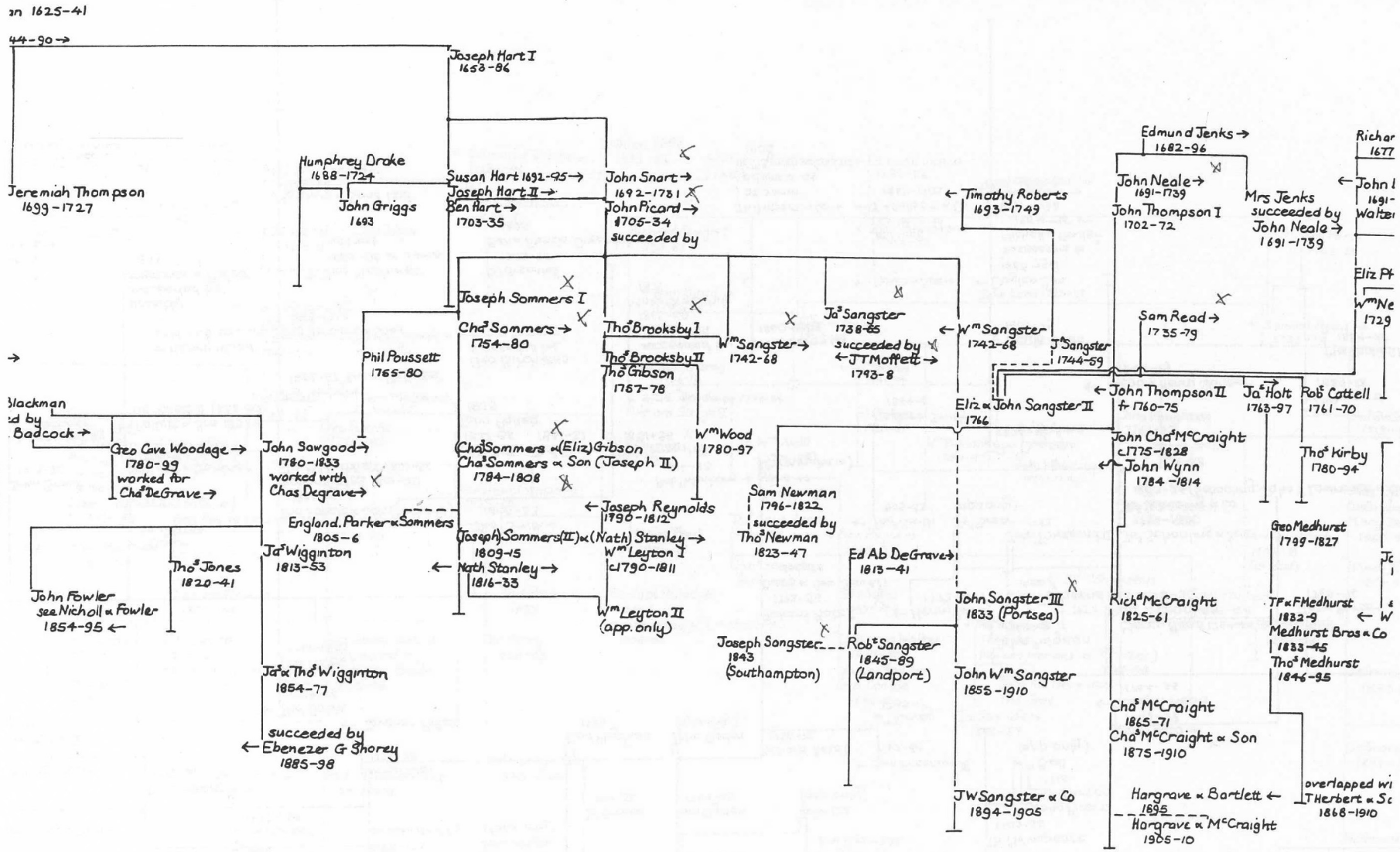

1730
1640
1650
1660
1670
1680
1690
1700
1710
1720
1730
1740
1750
1760
1770
1780
1790
1800
1810
1820
1830
1840
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
Rob Vincent II → 1751-93
Wm Brind → 1751-74
John Goodman → 1753-1804 succeeded by
Francis Gray → 1766-75
Wm Goodman → 1776-94
Tristram Blades 1786-96
Thos. Chancellor → 1781-99
succeeded by Thos. Chandler → 1780-1807
Chs Snart succeeded by 1789-1808
John Blades 1792-3
Richd Price 1800-15
John Snart II 1799-1832
Snart & Clark 1801
Neriah Snart 1832
England, Parker & Sommers 1805-6
Wm Lewis Nicholl → 1808-50
Kington & Trowbridge 1848-64
John Kington 1853
Chas. Trowbridge 1853
Rob Wedderburn I 1855
Jabez Wedderburn I 1860-75
Jas Wedderburn 1871
Jabez Wedderburn II 1883
Robert Wedderburn II 1883
Harriet Wedderburn 1883
Fred Wedderburn 1895-1974
Jas Wedderburn 1898
J Wedderburn & Co 1910
J Wedderburn & Son 1910
R Wedderburn & Sons 1910
Wm Smith 1802-47 → see Dutton & Smith →
Robt Hudson 1812-33
John Peck → 1817-42
succeeded by Webb & Skinner 1844-79 →
Hunt & Jas Seaton 1869
Wm Hunt 1830
Wm Hunt & Co 1871-1910
John James & Co 1851-55
David Hart 1856-65
David Hart & Co 1870-1930
RW Webb → 1831-71
Jas Stoddart 1875-88
Vandome & Hart Ltd → 1930-73.
Hunt & Co Scales Ltd 1939-74 owned by Vandome & Hart Ltd → owned by W & T Avery Ltd
1974 shared premises with Thos Jas Poupard
Thos Poll 1692-
Thos Pell 1703-18
Wm Plive 1716-84
← Fran 176

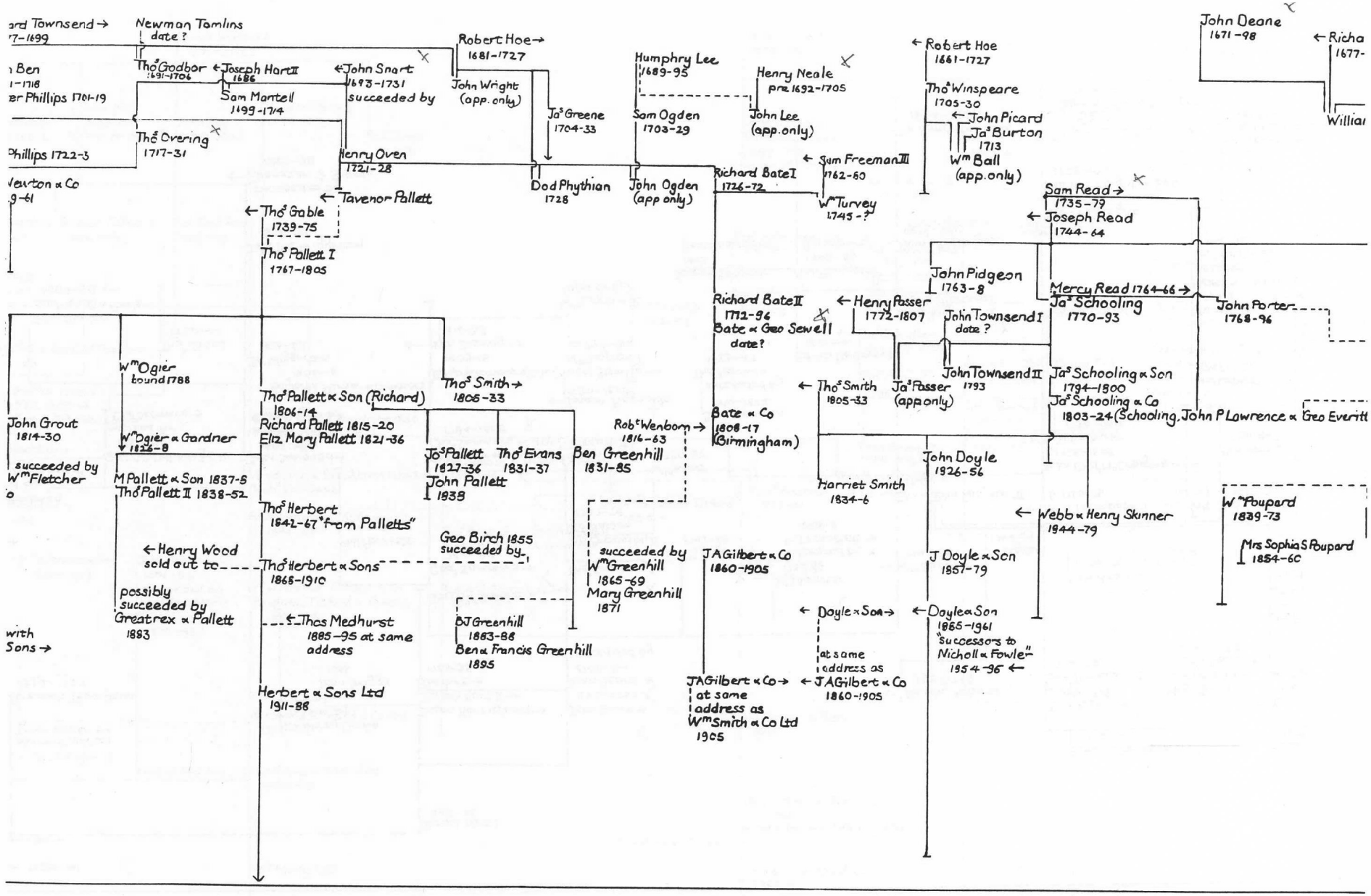

William Taylor I → 1662–1707
Thos Pollard → 1692–5
Timᵛ Roberts → 1693–1749
Thoˢ Pell 1703–18
Wᵐ Plivey 1716–84
Silas Jennings I 1720–61
Timᵛ Roberts & Son (Rich) 1731–44
Richard Roberts 1744–9
Thos Harrison 1752–82
Silas Jennings II 1750–83
← Francis Gray → 1766–75
Thos Williams → 1776–1835
Thoˢ Lee 1824–33
Ed Williams 1809–39
Geo Skinner [app. only]
Wᵐ Williams & Son → 1851–1913
Walter Williams dates ?
succeeded by Vandome, Titford & Co 1910–29
Chᵃˢ Mattock 1869–75
Mattock & Son 1889–1961
Mattock Automatic Scale Ltd 1939–66
Mattock & Son Ltd
Thos Calcott 16? – 1701
Weston Gowers 1690–1707
Richard Jackson 1716–24
Wᵐ Taylor (app. only)
Danˡ Thompson → 15–45
John Thompson II → 17? – 1775
← John Goodman 1753–1804
Thompson & Goodman 1772
Wᵐ Astill → 1776–1803
Astill & Susann
Astill
Astill
Ben Pa
Payne
succe
Jaˢ She
1835
Wᵐ Goodman → 1790–94
Ben Payne → 1795–1834
Wᵐ Fage → 1802–36
Jaˢ Dwenden 1811–34
Sam Phillips → 1817–54
Mrs E Phillips succeeded by John Burgess Figgins 1855–75
Henry Oxley 1761–93 →
John Dunn 1780–1805
Wᵐ Leyton I → c1792–1811
Sam Bassingham 1789–1828
Jaˢ Stewart c1799–1830
Jaˢ Grigg 1793–1883
John Grout → succeeded by Wᵐ Fletcher 1823–39
Wᵐ Brooks 1804–34
John Bunn 1832–47
Wᵐ Fran Fletcher 1837–60
Sam Pearce 1826–41
Geo Pearce 1855
Mrs S Fletcher
Fletcher & Geo Pearce 1865–69
H S Fletcher 1871
Wᵐ Bassingham 1818–47
succeeded by John Winsbury 1843–88
John Bassingham 1809–26
Robᵗ Bassingham 1823–42
Ebenezer Shorey 1838–53
John T Turner 1844–9
Ebenezer G Shorey → 1875–98
Henry C Shorey 1905–10
W Shorey 1910

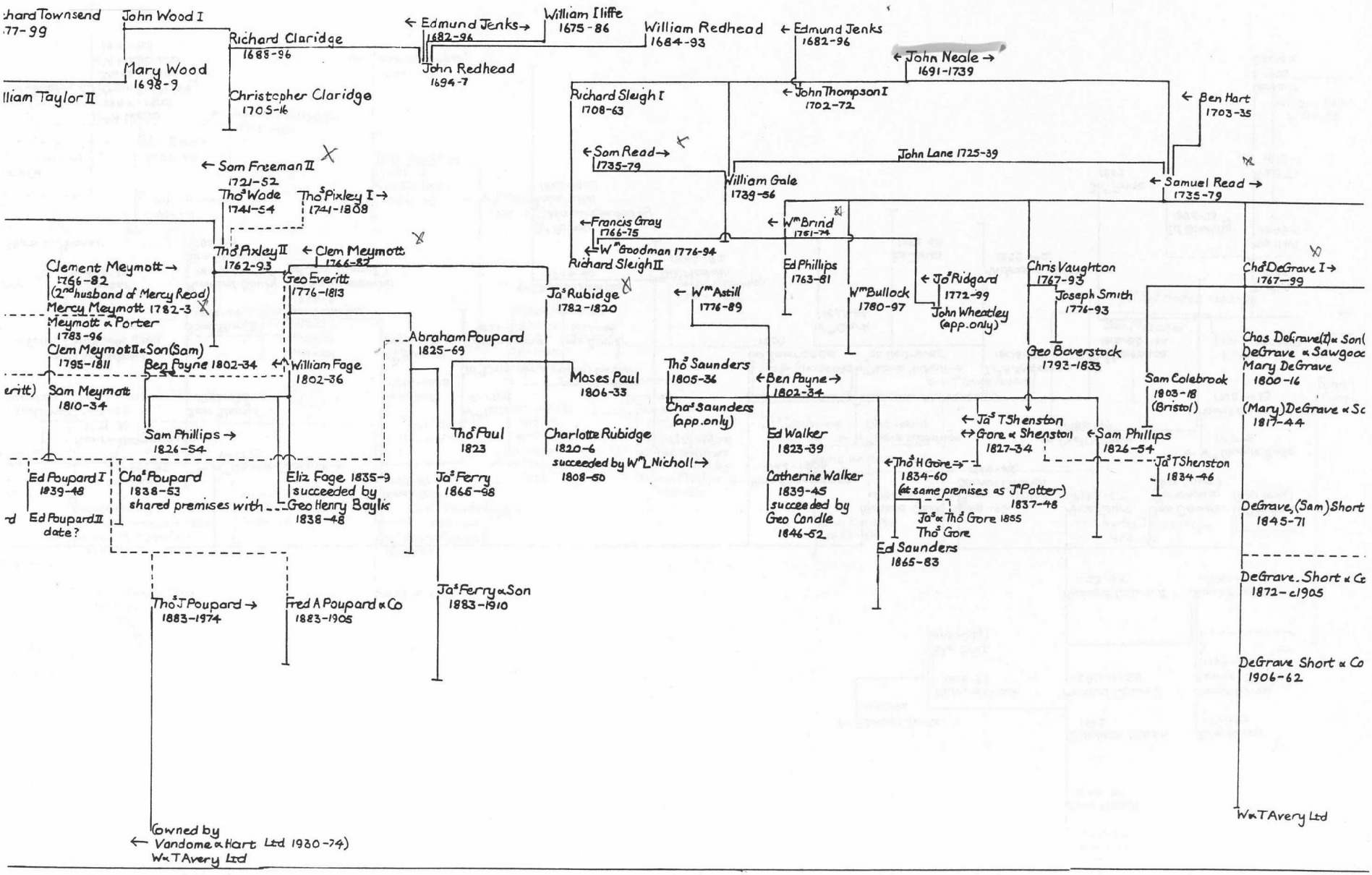

1732
Thomas Hux I 1666-87
Elizabeth Hux 1687-1703
Thomas II ∝ Eliz Hux I 1703-15
Elizabeth Hux II (married Plamb) 1718-22
Percivell Lamb ?-1725
Elizabeth Lamb 1726-?
William Taylor I 1662-1707
Timothy Roberts → 1693-1749
Joseph Lind 1700-30
John Lind → 1729-83
John Wood 1734-65
William Whitemarsh 1731-48
Wm Clark c1750
Robert Vincent II → 1751-93
Sam Whitford 1762-85 (Math inst. Maker)
Henry Oxley 1761-93
Thos Goulding succeeded by 1764-80
Richard Wood 1768-1620
Thos Bullwinkle 1750
Henry Passer → 1772-1807
Thos Williams 1776-1835
Thos King 1780-87
Joseph Trout ?-1786
Wm Astill
Jas Fletcher 1787
Thos Trout (app only)
John Wynn 1784-1814 → succeeded Thos Croome → 1769-93
John Wynn → 1784-1814
succeeded by Wm Skinner → 1794-6
Wm Skinner 1794-6
Geo Allmond 1794-1817
Jas Vincent → c1782-1805
Wm Allmond
Sarah Allmond 1824
Rob Vincent III 1823-60
Joseph Savage c1826
Jn Partridge 1790-94
Susannah Astill → 1795-97
John Partridge 1796
Astill ∝ King 1796 →
Astill ∝ Ben Payne → 1798-1803
Payne 1806-34 →
Payne ∝ Ovenden 1811-34
Jas Ovenden (Bristol)
joined Susannah Astill 1795-7
Thos Burchfield → 1810-45
Thos Burchfield 1810-45
John Bartlett (London ∝ Bristol)
Wynn ∝ Richard Wood 1815-20
Robt Wood 1817-53
Wm Clemson 1869-85
Hen. Pooley ∝ Son 1835-98 (Liverpool)
S Bartlett 1827-33
Ed Ab DeGrave → 1813-41
Chas Bartlett 1846-70 (Newcastle)
Chas Bartlett ∝ Co 1863-6
Chas Bartlett ∝ Son 1871-4
C H Bartlett ∝ Co 1877-8
Hargrave ∝ Bartlett → 1895
succeeded by Shenstone → 1835-46
Jos Morgan 1840-65 possibly succeeded by
Chas Morgan 1888-1905
Ed Stillwell I 1849-71
Ed Stillwell II 1875-1910
Robt ∝ Henry Wood 1854-61
Henry Wood 1862-8
succeeded by Thos Herbert ∝ Sons → 1868-1910
Thos Burchfield ∝ Son 1846-73
Jn Bartlett ∝ Son 1848-83
succeeded by Thos Williams II 1806-1910
Wm Clemson ∝ Son 1888-1910
Bartlett ∝ Son Ltd 1890-1913 (Bristol ∝ Cardiff)
succeeded by Henry Pooley ∝ Co Ltd 1910
succeeded by W ∝ T Avery Ltd 1913 (Birmingham)
Thos Vincent 1865-95
Alfred Savage ∝ Co 1869-1920
Chas Morgan ∝ Sons

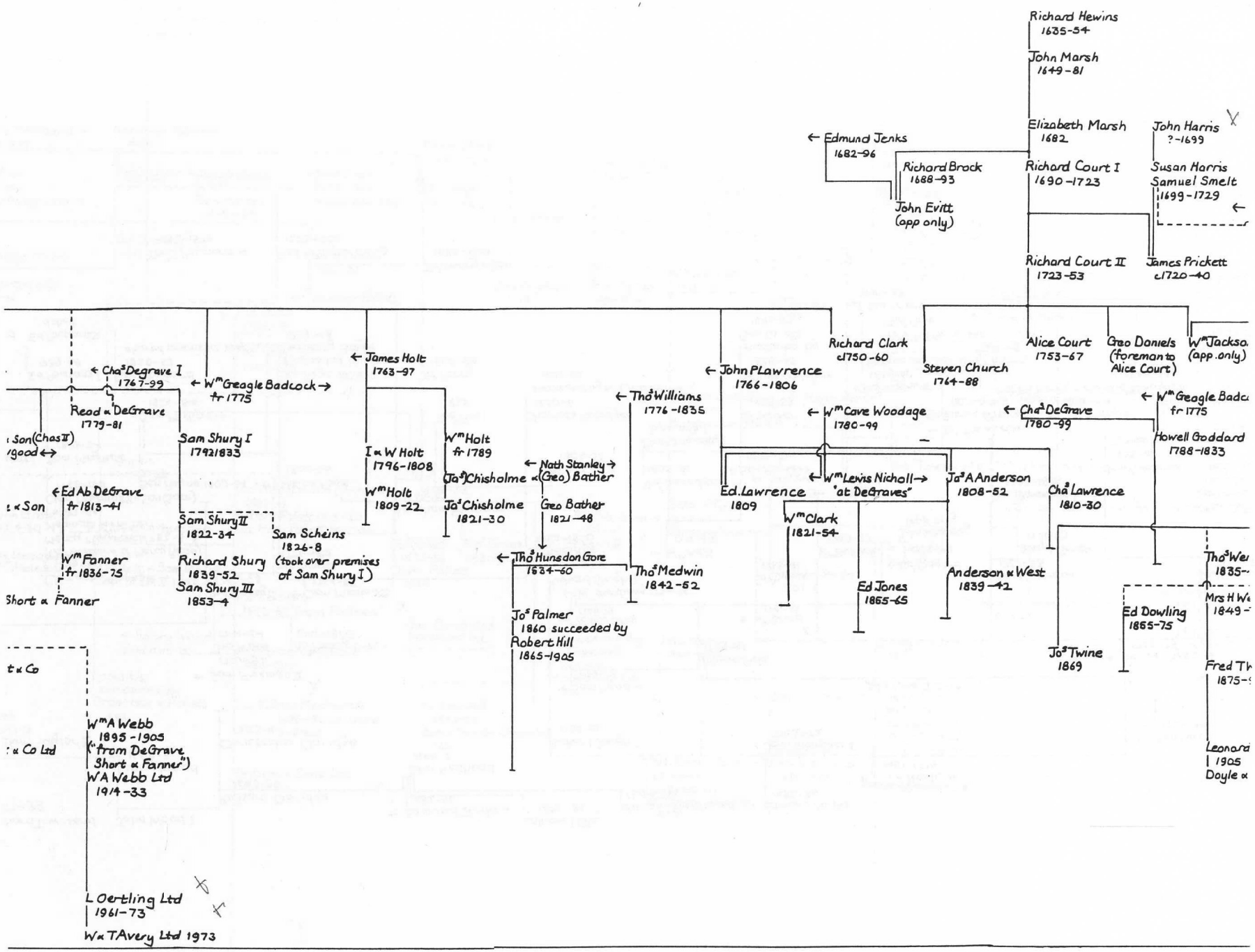

Robt Vincent I
pre 1736
Robt Vincent & Son
1736
Robt Vincent II
1751–93
John Swithin
1738–67
succeeded by
Wm Lamb
1764–99
Mary Lamb
1790–93
Jas Ridgard
1772–99
William Lewis
1758–62
Lewis & Wm Nicholl
Thos Croome
1769–93
succeeded by
John Wynn 1784–1814
Joseph Reynolds
1790–1812
Rob II & Jas Vincent
Jas Vincent
Vincent & Thos Chancellor
succeeded by
Jas Dutton & Wm Smith
Jas Dutton
1796–1824
Wm Smith
1802–47
John Peck
1817–42
Jas Richardson
1821–24
Josh Hawkes
1826–33
Hiatts
succeeded by
Wm Smith & Co
1832–94
Wm Henry Miles successors of
1827–74
Jonathan Walker
1833–69
Fred London
1831–50
succeeded by
R Dougal succeeded by
Sam Warmisham
1849–95
(London & Ipswich)
Jonath Walker & Son
1870–92
succeeded by
Booth & Simmons
1875
Henry Allchin
1875–98
Miles & Co
1883–1961
Walker, Driver & Sons
Walker, Driver & Warmisham
1898–1961
Wm Smith & Co Ltd
1905 at same
address as
JA Gilbert & Co
H Allchin & Co
1905–10
H Allchin & Co Ltd
all at same address
Warmisham & Shepherd
1898
Cocksedge & Co
1894–1913
Warmisham, Cocksedge & Co
1926–32
Robs Knowles
1869–85
R Knowles & Son
1885–1905
KA Knowles & Son
Reynolds & Wm Lewis Nicholl
1812–24
Thos Tadloo 1828
succeeded by
Jos Tadloo
1829–55
Nicholl & Co
1848–53
Nicholl & Wm Cave Fowler
1854–95
succeeded by
Doyle & Son
1885–1961
Richd W Webb
1821–71
Jos Tadloo
1829–55
Chs Mattock
1869–75
Thos Stanway
1870–85
at same
address as
RW Webb
821–71
Rd Webb & Co
1875–1966
Alf Tadloo
1860–85
at same address as
Doyle & Son and
Nicholl & Fowler
1854–95
John Martin
1871–1910
Phil Champion
1852–55
John Winsbury
1843–98
John Winsbury & Son
1883–1905
Henry Boas
1852
Ed Corderoy
?–1930
John Ben
1691–1718
Jonathan Hurley
1699–1702
Thos Payne
(app. only)
John Swi
1738–67
Jas Moffet
1765–87
Wm Pugh I
c1790–1811
Wm Pugh II
1811
Eliz Moffe
1783–9
Jas Thos Mo
Eliz Moffe
Eliz Moffe
1801–7
John Blac
1816–2
Isaac Blac
1833–4

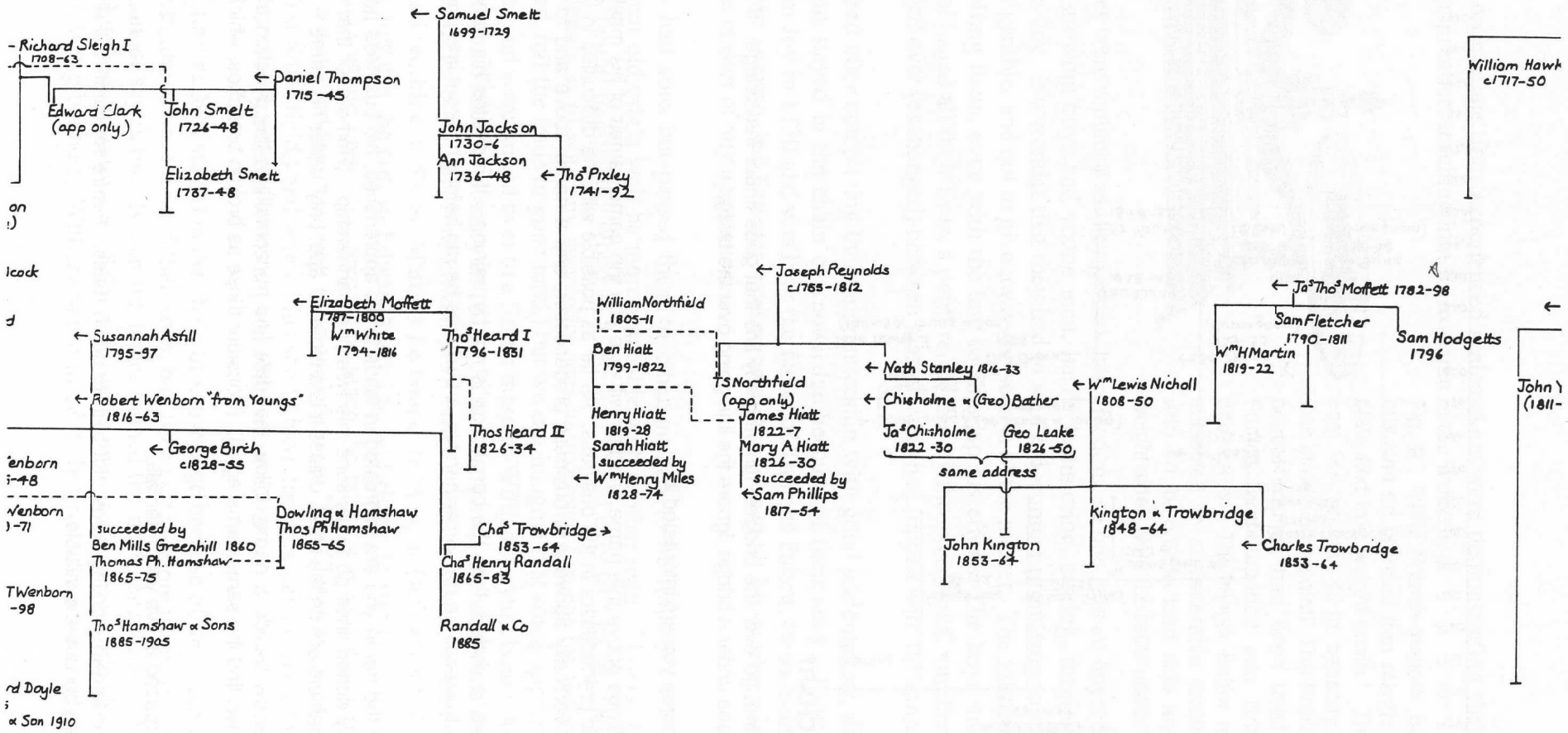

1734
David Wilford I 1671–c 1709
John Hall 1698–1719 "with Mr Gowers"
John Joy 1698–1747
David Wilford II c1716–50
Robt Jones 1712–14
Tavenor Pallett → (app. only)
Thos Gable → 1739–75
Moffett ∝ Son (Jas Thos) →
Moffett 1793–8
Moffett 1800 →
Moffett ∝ John Blackburn
Blackburn
Wm New ∝ Richd Vandome 1805
Richd Vandome ∝ Co 1806–14
Vandome ∝ Blackburn 1817–30
Richd Vandome
Richd Vandome, Titford ∝ Co 1841–65?
Wm Williams ∝ Son 1851–1913
John James ∝ Co 1851–55
succeeded by David Hart 1855–65
David Hart ∝ Co 1870–1930
Wm ∝ Arthur Titford ∝ Co
Vandome, Titford ∝ Pawson 1868–98
succeeded by Vandome, Titford ∝ Co Ltd 1910–29
succeeded by
Vandome ∝ Hart Ltd 1930–73
W ∝ T Avery Ltd
Thos Bastick ∝ Jas Sam Driver 1822–46
Richd Vandome, Titford 1834 —
Thos Bastick ∝ Son (Richard)
Richard Bastick 1849–50
Richard Bastick ∝ Son 1864–1914
Richd Bastick 1828–51
Driver ∝ Sons 1855–1913
Geo Driver ∝ Son 1910
Geo Driver ∝ Son Ltd ?–1966
owned by W ∝ T Avery Ltd
Southall ∝ Smith
Driver Southall Ltd 1966 —
Robert Saunders 1634–61
William Moore 1647–59
Chris Grove I 1674–92
Chris Grove II
Rebecca Grove 1699–1703
(widow of C Grove I)
Robert Alcocke 1703–6
Sarah Sherman 1642
Henry Sherman I
Sam Neale 1644–
Sam Freeman I 1676–1714
Wm Bennett 1697–1705
Thos Pollard 1692–95
Rebecca Freeman 1714
Sam Freeman II → 1721–52
Sam Freeman II → 1721–52
Joseph Read → 1744–64
Chas Sommers → 1754–80
Thos Jefferson pre 1760
John Wornell → 1743–60
Geo Sewell →
Ben O'Briant (app. only)
Thos Reeves 1762–89
Sam Freeman II ∝ Son (Sam III) → 1752–62
Sam Freeman III 1762–80
Solomon Black succeeded by Wm Geagle Bac 1775–93
Thos Chandler pre 1780–1807
Sewell ∝ John Young I → 1785–1801
Freeman ∝ Wm New 1780–82
Wm New 1782–98
New ∝ Co 1798–1807
Thos Grove I 1786
John Young I 1802–10
John Young I ∝ Son (John II) 1811–1901
Thos Grove II (app. only)
Thos Hunsdon Gore → 1825–40
Geo Young 1823–47
Eliz. Young 1848–52
Young, Son ∝ Morlow 1902–72

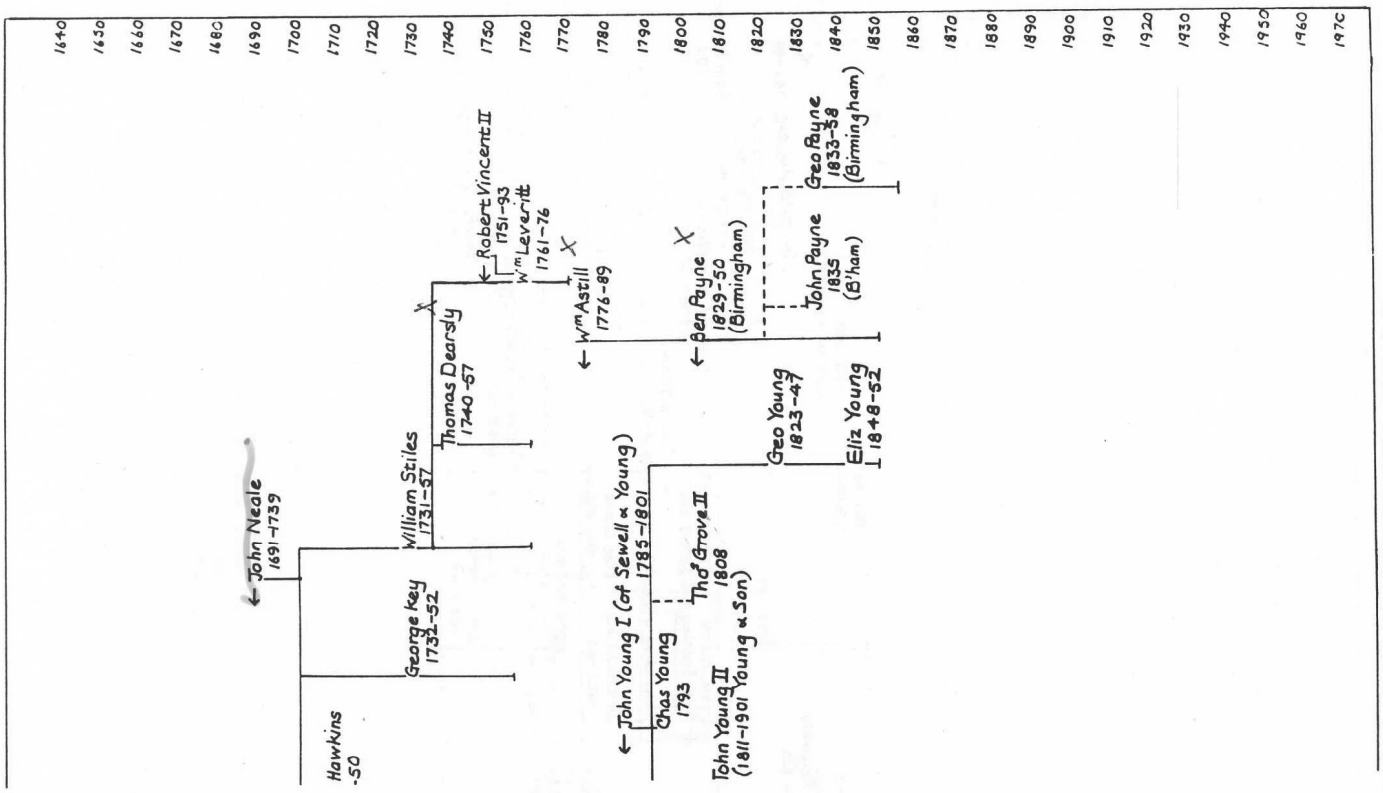

1735
an 1625-41
44-90 →
Jeremiah Thompson 1699-1727
Joseph Hart I 1653-86
Humphrey Drake 1688-1724
John Griggs 1693
Susan Hart 1692-95 →
Joseph Hart II →
Ben Hart → 1703-35
John Snart → 1692-1731
John Picard → 1705-34 succeeded by
Joseph Sommers I
Cha³ Sommers → 1754-80
Phil Poussett 1765-80
Tho⁵ Brooksby I
Tho⁵ Brooksby II
Tho⁵ Gibson 1757-78
Wm Sangster → 1742-68
Ja³ Sangster 1738-85 succeeded by ← JT Moffett → 1793-8
← Timothy Roberts 1693-1749
← Wm Sangster 1742-68
J³ Sangster 1744-59
Edmund Jenks → 1682-96
John Neale → 1691-1739
John Thompson I 1702-72
Mrs Jenks succeeded by John Neale → 1691-1739
Richar 1677
← John I 1691-
Walter
Eliz Pf
Wm Ne 1729
Sam Read → 1735-79
← John Thompson II fr 1760-75
Ja² Holt 1763-97
Rob⁵ Cattell 1761-70
Eliz ∝ John Sangster II 1766
John Cha⁴ McCraight c1775-1828
← John Wynn 1784-1814
Tho⁵ Kirby 1780-94
Wm Wood 1780-97
Cha³ Sommers ∝ (Eliz) Gibson
Cha³ Sommers ∝ Son (Joseph II) 1784-1808
Joseph Reynolds 1790-1812
Sam Newman 1796-1822 succeeded by Tho³ Newman 1823-47
Ed Ab DeGrave → 1813-41
John Sangster III 1833 (Portsea)
Joseph Sangster 1843 (Southampton)
Rob² Sangster 1845-89 (Landport)
John Wm Sangster 1855-1910
JW Sangster ∝ Co 1894-1905
Rich⁴ McCraight 1825-61
Cha⁵ McCraight 1865-71
Cha⁴ McCraight ∝ Son 1875-1910
Hargrave ∝ Bartlett ← 1895
Hargrave ∝ McCraight 1905-10
Geo Medhurst 1799-1827
TF ∝ F Medhurst 1832-9
Medhurst Bros ∝ Co 1833-45
Tho⁵ Medhurst 1846-95
overlapped wi
T Herbert ∝ Sc 1868-1910
Blackman
d by
Badcock →
Geo Cave Woodage → 1780-99 worked for Cha⁴ DeGrave →
John Sawgood → 1780-1833 worked with Chas Degrave →
England. Parker ∝ Sommers 1805-6
Joseph Sommers (II) ∝ (Nath) Stanley → 1809-15
← Nath Stanley → 1816-33
Ja⁵ Wiggington 1813-53
Tho³ Jones 1820-41
John Fowler see Nicholl ∝ Fowler 1854-95 ←
Wm Leyton I c1790-1811
Wm Leyton II (app. only)
Ja⁵ ∝ Tho⁵ Wiggington 1854-77
succeeded by ← Ebenezer G Shorey 1885-98


1736
ard Townsend →
7–1699
Newman Tamlins
date ?
Robert Hoe →
1681–1727
Humphry Lee
1689–95
Henry Neale
pre 1692–1705
← Robert Hoe
1681–1727
John Deane
1671–98
Richa
1677–
Ben
1–1718
er Phillips 1701–19
Thos Godbor
1691–1706
← Joseph Hart II
1686
Sam Martell
1699–1714
← John Snart
1693–1731
succeeded by
John Wright
(app. only)
Ja s Greene
1704–33
Sam Ogden
1703–29
John Lee
(app. only)
Thos Winspeare
1705–30
← John Picard
Ja s Burton
1713
Wm Ball
(app. only)
Willia
Phillips 1722–3
Thos Overing
1717–31
Henry Oven
1721–28
Dod Phythian
1728
John Ogden
(app only)
Richard Bate I
1726–72
← Sam Freeman III
1762–80
Wm Turvey
1745–?
Sam Read →
1735–79
← Joseph Read
1744–64
Newton & Co
9–61
← Thos Gable
1739–75
← Tavenor Pallett
Thos Pallett I
1767–1805
John Pidgeon
1763–8
Mercy Read 1764–66 →
Ja s Schooling
1770–93
John Porter
1768–96
Richard Bate II
1772–96
Bate & Geo Sewell
date?
← Henry Passer
1772–1807
John Townsend I
date ?
Wm Ogier
bound 1788
Thos Smith →
1806–33
Thos Pallett & Son (Richard)
1806–14
Richard Pallett 1815–20
Eliz Mary Pallett 1821–36
Thos Smith
1805–33
Ja s Passer
(app only)
John Townsend II
1793
Ja s Schooling & Son
1794–1800
Ja s Schooling & Co
1803–24 (Schooling, John P Lawrence & Geo Everitt
John Grout
1814–30
Wm Ogier & Gardner
1826–8
Jos Pallett
1827–36
Thos Evans
1831–37
Ben Greenhill
1831–85
Robt Wenborn →
1816–63
Bate & Co
1808–17
(Birmingham)
John Doyle
1926–56
succeeded by
Wm Fletcher
o
M Pallett & Son 1837–5
Thos Pallett II 1838–52
John Pallett
1938
Harriet Smith
1834–6
Thos Herbert
1842–67 "from Palletts"
← Webb & Henry Skinner
1944–79
W m Poupard
1839–73
Mrs Sophia S Poupard
1854–6C
← Henry Wood
sold out to
Geo Birch 1855
succeeded by
Thos Herbert & Sons
1868–1910
succeeded by
Wm Greenhill
1865–69
Mary Greenhill
1871
JA Gilbert & Co
1860–1905
J Doyle & Son
1957–79
possibly
succeeded by
Greatrex & Pallett
1893
← Thos Medhurst
1885–95 at same
address
BJ Greenhill
1863–88
Ben & Francis Greenhill
1895
← Doyle & Son →
at same
address as
JA Gilbert & Co
1860–1905
← Doyle & Son
1865–1961
"successors to
Nicholl & Fowle"
1954–96 ←
with
Sons →
Herbert & Sons Ltd
1911–88
JA Gilbert & Co →
at same
address as
Wm Smith & Co Ltd
1905


hard Townsend
77-99
John Wood I
Mary Wood
1698-9
lliam Taylor II
Richard Claridge
1688-96
Christopher Claridge
1705-16
← Edmund Jenks →
1682-96
John Redhead
1694-7
William Iliffe
1675-86
William Redhead
1684-93
← Edmund Jenks
1682-96
← John Neale →
1691-1739
Richard Sleigh I
1708-63
← John Thompson I
1702-72
← Ben Hart
1703-35
← Sam Freeman II
1721-52
Thos Wade
1741-54
Thos Pixley I →
1741-1808
← Sam Read →
1735-79
John Lane 1725-39
William Gale
1739-56
← Samuel Read →
1735-79
← Francis Gray
1766-75
← Wm Brind
1761-74
← W Goodman 1776-94
Richard Sleigh II
Thos Pixley II
1762-93
← Clem Meymott
1766-82
Clement Meymott →
1766-82
(2nd husband of Mercy Read)
Mercy Meymott 1782-3
Meymott « Porter
1783-96
Clem Meymott II « Son (Sam)
1795-1811
Sam Meymott
1810-34
Geo Everitt
1776-1813
Ben Payne 1802-34
William Fage
1802-36
Abraham Poupard
1825-69
Sam Phillips →
1826-54
Ed Poupard I
1839-48
Ed Poupard II
date?
Chas Poupard
1838-53
shared premises with
Eliz Fage 1835-9
succeeded by
Geo Henry Baylis
1838-48
Thos Paul
1823
Jas Ferry
1865-98
Thos J Poupard →
1883-1974
Fred A Poupard « Co
1883-1905
Jas Ferry « Son
1883-1910
Owned by
← Vandome « Hart Ltd 1930-74)
W « T Avery Ltd
Jas Rubidge
1782-1820
Moses Paul
1806-33
Charlotte Rubidge
1820-6
succeeded by Wm L Nicholl →
1808-50
← Wm Astill
1776-89
Thos Saunders
1805-36
Chas Saunders
(app. only)
Ed Phillips
1763-81
Wm Bullock
1780-97
← Jos Ridgard
1772-99
John Wheatley
(app. only)
Ben Payne →
1802-34
Ed Walker
1823-39
Catherine Walker
1839-45
succeeded by
Geo Condle
1846-52
Chris Vaughton
1767-93
Joseph Smith
1776-93
Geo Boverstock
1793-1833
← Jas T Shenston
↔ Gore « Shenston
1827-34
← Thos H Gore →
1834-60
(at same premises as J Potter)
1837-48
Jas « Thos Gore 1855
Thos Gore
Ed Saunders
1865-83
Sam Colebrook
1803-18
(Bristol)
← Sam Phillips
1826-54
Jas T Shenston
1834-46
Chas DeGrave I →
1767-99
Chas DeGrave (I) « Son (
DeGrave « Sawgoo
Mary DeGrave
1800-16
(Mary) DeGrave « Sc
1817-44
DeGrave, (Sam) Short
1845-71
DeGrave. Short « Ce
1872-c1905
DeGrave Short « Co
1906-62
W « T Avery Ltd


1738
Richard Hewins
1635-54
John Marsh
1649-81
Elizabeth Marsh
1682
John Harris
?-1699
Edmund Jenks
1682-96
Richard Brock
1688-93
John Evitt
(app only)
Richard Court I
1690-1723
Susan Harris
Samuel Smelt
1699-1729
Richard Court II
1723-53
James Prickett
c1720-40
Richard Clark
c1750-60
Steven Church
1764-88
Alice Court
1753-67
Geo Daniels
(foreman to
Alice Court)
Wm Jackso
(app only)
Chas Degrave I
1767-99
Wm Geagle Badcock
fr 1775
James Holt
1763-97
Thos Williams
1776-1835
John P Lawrence
1766-1806
Wm Cave Woodage
1780-99
Chas DeGrave
1780-99
Wm Geagle Badc
fr 1775
Howell Goddard
1788-1833
Read & DeGrave
1779-81
Son (Chas II)
/good ↔
Sam Shury I
1792/1833
I & W Holt
1796-1808
Wm Holt
fr 1789
Nath Stanley
(Geo) Bather
Jas Chisholme
Jas Chisholme
1821-30
Geo Bather
1821-48
Wm Lewis Nicholl
"at DeGraves"
Jas A Anderson
1808-52
Ed. Lawrence
1809
Wm Clark
1821-54
Chas Lawrence
1810-30
Ed Ab DeGrave
fr 1813-41
Son &
Wm Fanner
fr 1836-75
Short & Fanner
Sam Shury II
1822-34
Sam Scheins
1826-8
(took over premises
of Sam Shury I)
Richard Shury
1839-52
Sam Shury III
1853-4
Wm Holt
1809-22
Thos Hunsdon Gore
1834-60
Thos Medwin
1842-62
Jos Palmer
1860 succeeded by
Robert Hill
1865-1905
Ed Jones
1865-65
Anderson & West
1839-42
Ed Dowling
1865-75
Jos Twine
1869
Thos Wel
1835-
Mrs H We
1849-
Fred Th
1875-
Leonard
1905
Doyle &
t & Co
: & Co Ltd
Wm A Webb
1895-1905
("from DeGrave,
Short & Fanner")
W A Webb Ltd
1914-33
L Oertling Ltd
1961-73
W & T Avery Ltd 1973


- Richard Sleigh I
1708-63
Edward Clark
(app only)
John Smelt
1726-48
Elizabeth Smelt
1737-48
← Daniel Thompson
1715-45
← Samuel Smelt
1699-1729
John Jackson
1730-6
Ann Jackson
1736-48
← Thos Pixley
1741-92
William Hawk
c1717-50
on
:)
lcock
d
← Elizabeth Moffett
1787-1800
Wm White
1794-1816
Thos Heard I
1796-1851
Thos Heard II
1826-34
← Susannah Ashill
1795-97
← Robert Wenborn "from Youngs"
1816-63
← George Birch
c1828-55
'enborn
:-48
Wenborn
)-71
succeeded by
Ben Mills Greenhill 1860
Thomas Ph. Hamshaw
1865-75
Dowling & Hamshaw
Thos Ph Hamshaw
1865-65
TWenborn
-98
Thos Hamshaw & Sons
1885-1905
rd Doyle
;
& Son 1910
Cha$ Trowbridge →
1853-64
Cha$ Henry Randall
1865-83
Randall & Co
1885
William Northfield
1805-11
Ben Hiatt
1799-1822
Henry Hiatt
1819-28
Sarah Hiatt
succeeded by
← Wm Henry Miles
1828-74
← Joseph Reynolds
c1765-1812
T S Northfield
(app only)
James Hiatt
1822-7
Mary A Hiatt
1826-30
succeeded by
← Sam Phillips
1817-54
← Nath Stanley 1816-33
← Chisholme & (Geo) Bather
Ja$ Chisholme
1822-30
Geo Leake
1826-50,
same address
John Kington
1853-64
Kington & Trowbridge
1848-64
← Wm Lewis Nicholl
1808-50
← Ja$ Tho$ Moffett 1782-98
Sam Fletcher
1790-1811
Wm H Martin
1819-22
Sam Hodgetts
1796
Charles Trowbridge
1853-64
John
(1811-



TO USE THIS CHART

To follow any line, go over the bridges, ignoring any line that goes under that bridge. If the line that you are following goes under a bridge, ignore the line going over the bridge.

Start with any name you are interested in.

Go up the line/lines above this name and this will give you the name/names of his master/masters, who may also be his predecessor in the business. As far as possible with the difficulties in the design of the chart, a name vertically above is a business predecessor, and a name above and to the side is of a master.

If the line above is dotted, then the connection is not by training. It indicates his father, his business predecessor, a business he ran in partnership, a business he ran before he went into partnership, or that of a spouse.

Any line below the name you are interested in leads to his apprentices, his business partnership, or his successor, Any dotted lines go to his sons, his wife or a partnership. (Remember that only apprentices who became masters are on the chart, unless it is annotated 'app. only' under his name.)

If there is an arrow beside a name, follow that date line horizontally in the direction of the arrow, and eventually you will find the same name again. (Consider those as broken branches, which were detached for clarity.)

Date lines are spaced at five year intervals.

Dates given are known working dates, not birth to death dates. Future research will alter the dates as more information becomes available.

century. So, on average, four experienced scalemakers were demonstrating their methods and skills to each apprentice, teaching him by example in the workshop.

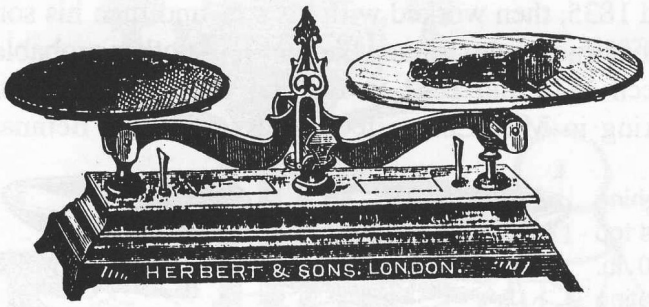


Fig. 9 "New French pattern balance weighing machine on bronzed iron stand, fitted with china plate and iron weight scale." The 4 lb. capacity cost 14/- and the 40 lb. capacity cost 30/-. New was stretching a point! The French roberval, with central column, had been used since 1840 in France, and imported into Britain quite soon afterwards. The single beam must have been subjected to considerable torque when loaded with 40 lb. on the load side and 40 lb. on the weight side! Note the rests under the beam.

The apprentices were replaced as they gained their freedom, so one gets an impression of a house full of noisy, growing boys and young men, busily hammering, casting, forging and filing for twelve hours a day. No wonder that they had to sign a document promising to obey the master, not to drink or gamble, and not to give away the secrets of the master. The master must have had trouble controlling them, even with the law backing up his efforts. The boys must have forged friendships that lasted all their lives, a point reinforced by the exceptional number of apprentices who were turned over (exchanged) between masters who had trained with the same master.

Some men, freed after completing their apprenticeship with good scalemakers, did not take any apprentices, but stayed in the chain of knowledge because of their sons. Tavenor Pallett was trained by John Joy in 1730 and was later the father of Thomas Pallett, (who trained three future masters,) but we assume that Tavenor worked as a journeyman all his working life, as he is not recorded as the master of any apprentices.

Some masters had sons but passed them to other masters to be trained. We can imagine a 'difficult' 14 year old might well be more amenable with another man. Thomas Goulding's son, Somerset, was bound to Richard Wood in 1780, and turned over to Charles DeGrave in 1786. We have no details as to why any apprentice was turned over, (except for the cases where the master had died, left the trade or gone mad,) but we can imagine that some apprentices proved to be obstreperous and were turned over to a firmer master. William Layton bound his son, William Thomas Layton, to Nathaniel Stanley in 1811. John Peter Lawrence was a scalemaker, working 1800 to 1806, but he bound his son, Edward, to George Cave Woodage, a scalemaker living in Grub Street, and working at 59, St. Martin's Le Grand, (that is, at DeGrave's.) Christ's Hospital contributed £5 towards the cost of Edward's training, and Henry Dixon's charity contributed £4, contributions that would only have been made when the father was very poor, so perhaps John Peter Lawrence was working in a poky little workshop (in 'The Cloysters' at St. Bartholomew's Hospital in West Smithfield,) and wanted his son to have the great advantage of working within one of the grandest scalemakers' workshops in England in 1792.

Many 19th century makers stayed in the chain of knowledge because of their family connections, and must be assumed to have trained their sons, but, because the apprenticeship system no longer operated, we cannot say definitely that the father trained the next generation. Our ignorance is demonstrated by these examples:- Robert Arthur Knowles just crept into the apprenticeship system himself, being bound to William Smith in 1845, but we have no records for his son who

was working with him by 1885, just near the present–day Bermondsey Market, (where many of you will have hunted for scales in the early hours,) and later in Lambeth. The probable son appeared independently in 1910, still just south of the river Thames, as K A Knowles and Son. Samuel Lench was working between 1825 and 1835, then worked with his son, and then his son Samuel II worked alone until 1850, but we do not know who trained Samuel I. Another probable examples was Samuel Pearce, working between 1826 and 1841 in Bethnal Green, who might have been the father of George Pearce, working in Mile End, a few blocks south of Bethnal Green, in 1855.

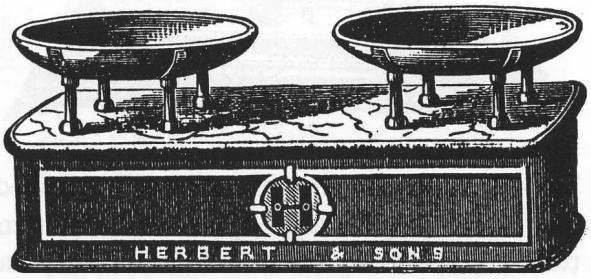


Fig. 10 "New French pattern balance weighing machine. Ebony or walnut wood stand and marble top with brass scales." 2 lb. capacity 25/–, and 40 lb. capacity 60/–. 'Balance', in this case, meant vibrating as opposed to accelerating. Beranger invented the linkage system in 1847. Some companies made the smaller capacities with two vertical supports and their larger capacities, over 20 lb., with four supports.

In many cases, a good scalemaker trained his own sons, but the sons took no apprentices, and apparently, did not work independently. William Sangster trained Henry Sangster from 1744, but we have no record of Henry's independence. He could have become ill, died or taken up some other trade, but there are so many examples of son's taking no apprentices that it must be assumed that many relations stayed in the workshop, forming a reliable workforce. John Blackburn trained John and James, his sons, and William Blackburn, his nephew, in the early 1800s. Richard Sleigh I trained his younger brother, George from 1709, and his son, Richard Sleigh II, but even Richard II was not freed until his father died in 1763.

Some companies chased up recalcitrant masters, to make sure that they freed their apprentices promptly after seven years, but Blacksmiths' frequently did not bother, and consequently lost a lot of revenue which should have come to them in quarterly fees, to be used for pensions, feasts, and any legal expenses incurred. The time that Blacksmiths' stirred themselves was when they wanted to prevent an apprentice from joining another company, for example, in 1783, when they chased Joseph Sommers II, but they were too late, as Joseph was already a member of his father's company, Skinners', so he could not be compelled to join Blacksmiths'. Some masters did in fact join a second company, and paid two lots of Quarterage, and risked having to pay for and supervise two Feast Days. Presumably it gave the master the opportunity to take two lots of apprentices legally. [See the reference to Francis Gray on page 1726.] Thomas Williams trained his son, Thomas Wynn Williams, from 1801 until 1809, Edward Williams I, William Williams, George Williams and Edward Williams II. The relationship was not recorded for the later Williams, but they were probably relatives of Thomas Williams.

George Daniells entered the chain of knowledge without taking any apprentices because of his job. He was trained by Richard Court II at their shop on London Bridge, and was freed in 1737. We found no further evidence of him until his late master died in about 1752. Then he signed receipts for his mistress, Alice Court, widow, the new owner of the business. She took over the three partly trained apprentices for about three years, and took two new apprentices. If George Daniells was working as her foreman, it seems justifiable to believe that Daniells supervised their day–to–day training.

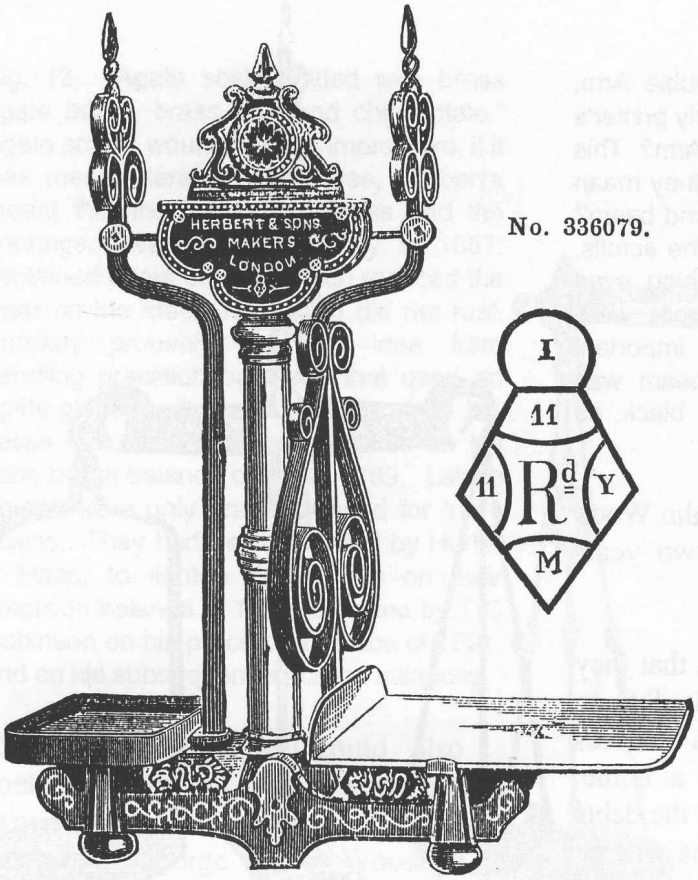


Fig. 11 "New Registered Pattern International Inverted Weighing Machine." 336079 was allocated in about 1900. The diamond registration mark was allocated on 11th June 1879. "Fitted with ornamental scrolls, china plate and scale, japanned white and gold. This machine is specially recommended to butchers, cheesemongers and provision dealers, as from improvements introduced it is equal in its action to a scale beam." The terminology here is odd. 'Inverted' usually applied to roberval scales with the two top linkages placed one above the other to leave room for the stays to be offset, the left hand stay being offset to the right of the central pillar, and the right hand stay being offset to the left of the pillar. This scale, however, was drawn with the two top stays in the same plane, as if they were only one stay Is that what 'International' meant? Is that why Herbert's compared it with a scale beam, by which, I assume they mean an equal-arm beam?

John Goodman also worked as a Foreman. He was Foreman to John Thompson Senior (who had partly trained him,) and had a lot of responsibility, because his elderly master retired to Hampshire, leaving him to run the shop and train the apprentices. He went on to work for himself in the Snow Hill area from 1784 until 1804.

Some masters took apprentices, none of whom became masters. Were they providing a poor training? Were the apprentices very poor boys, whose family could not help them to set up on their own? Was life so satisfactory as a subordinate that they did not want the problems associated with running a shop? Richard Sleigh I had eight apprentices, none of whom became masters. Thomas Brooksby II had five apprentices, none of whom became masters. John Hall had seven apprentices between 1702 and his death in 1725, but none distinguished himself. Thomas Croome had five between 1769 and 1786.

Widows were legally allowed to run the business of their late husband, and took apprentices. Rebecca Freeman, widow of Samuel Freeman I, took an apprentice in 1714. Rebecca Grove, took over the business of her late husband, Christopher, by 1699, and took an apprentice, John Westricher, in 1703, but she must have found the business too much for her, as she was given a pension by Blacksmiths' by 1708. Susan Hart took over the business of her son, Joseph Hart II, when he died, after a tragically short life, in 1692. She was the widow of Joseph Hart I, and presumably, was very keen to keep the business going until little Benjamin, her younger son, was old enough to take over in 1703. He continued the business until, at least, 1735, so her efforts were rewarded. Elizabeth Hux I and Elizabeth Hux II played their parts in keeping the Hux dynasty going in the early 1700s. Mary Lamb continued the business of William Lamb from

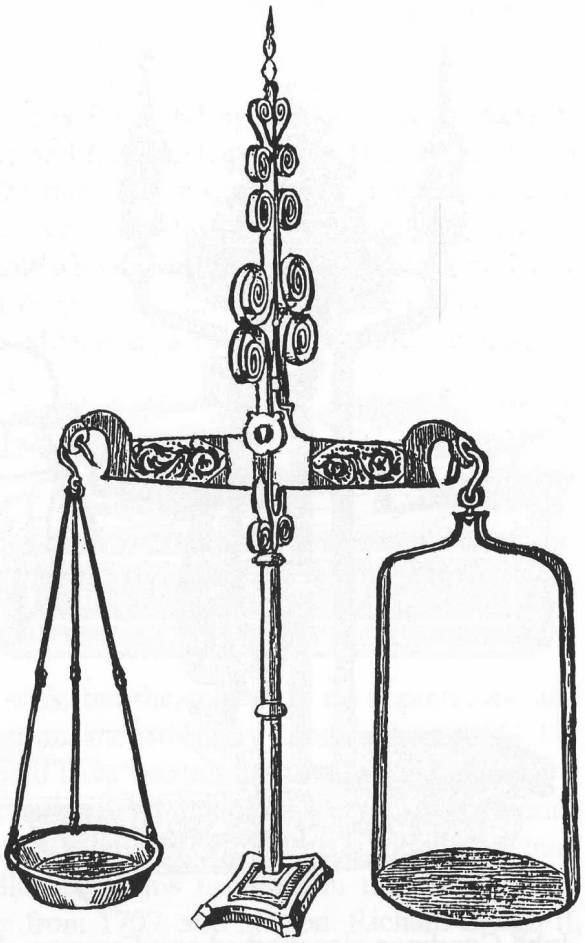


Fig. 12 "Scroll stand scale fitted with Double Arm, Brass Weight Scale, etc." Another of the early printer's blocks, again with odd terminology. Double Arm? This term seems to be unique to Herbert's. Did they mean that the beam was double the depth of a round beam? The pointer was partially obscured behind the scrolls, but that probably didn't matter for crude weighing, even on the counter of a shop, where the scrolls were supposed to give a decorative and important appearance to the shop. The painted beam was probably painted with terracotta red on the black, as was traditional in Britain.

1790 to 1793. Mary Wood, widow of John Wood I, continued the business for at least two years after his death, until 1698.

A feature of the widows' businesses was that they seldom survived for long, and one is left to speculate on how difficult it was to run a business and simultaneously be responsible for a home. How easy it was, as a woman, to recover the debts of her late husband? How dependent she was on her Foreman? Could she get credit in the way that a man could? Would the public buy from a woman with the same confidence as they would from a man? Did the journeymen and apprentices worked as hard for a woman as they did for a man? Could any company be well run by somebody who had not been trained for that trade?

Exceptions to the brief struggles by the women above, were Elizabeth Phillips, who worked from 1722 until 1741 and Mary DeGrave, who worked from 1799 until 1844.

There was a gradual break-down in the apprenticeship system after 1814, when London changed the rules, (the Statute of Artificers,) as to who could start a business within the City boundaries. It was no longer compulsory to have trained for seven years, and the Companies lost their pre-eminence. They stopped keeping careful records and consequently, the chains of knowledge are not known now. Of course, if members of a family split up and set up separate businesses, we can presume a continuation of the chains of knowledge, as with the Wedderburn family, spread over South-East London, and the Bartlett family, spreading out to Bristol, Portsea and Newcastle to set up successful companies in the 19th century.

Many scalemakers were listed in Trade Directories in the 19th century, for whom we have no training records. James Gardner was working from 1855 until 1910, and could have been related to Thomas Gardner, and linked to the chain of Wal Gardner, Gardner & Sons and Gardner & Sons Ltd, who were still working in 1966. Because such men were not known to be in a chain of knowledge that was connected with Herbert's, they are not on the chart, which gives a distorted picture of scalemaking in London in the 19th and 20th century.

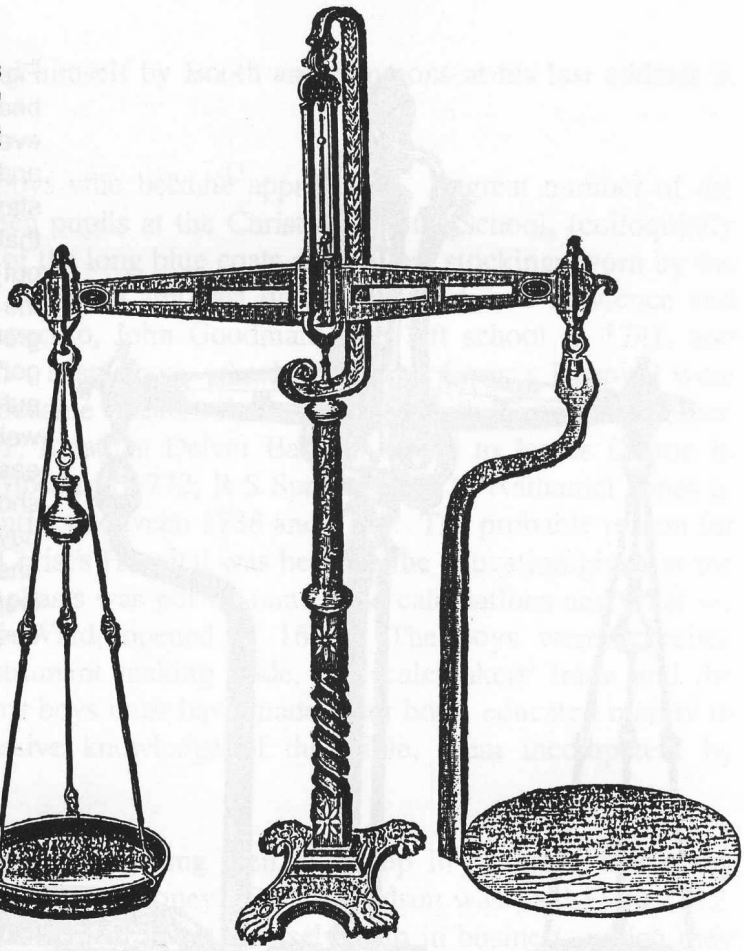


Fig. 13 "Agate scales, fitted with brass agate beam, brass arm and china plate." Agate scales would be quite impressive, if it was meant literally! Of course, Herbert's meant that the beam was brass and the bearings, invented by Sharkey in 1857, contained agate bushes, which reduced the wear on the steel knives and did not rust. Sharkey probably got the idea from handling precision balances that used an agate plane for the steel knives to bear on. Jesse Ramsden used such planes on his cone beam balance of about 1789. Lattice beams were only gradually used for trade scales. They had been invented by Hurter & Haas, to lighten the beams on their precision balance of 1793, used too by T C Robinson on his precision balance of 1821, and on his subsequent precision balances.

Chains of knowledge could also continue through the workshop experience of people like John Sawgood, George Cave Woodage and William Lewis Nicholl who boasted, when they set up independent businesses, of their time with DeGrave's. Similarly, Robert Wenborn stated that he was 'from Young's' and Thomas Herbert, '17 years with Pallet's.' William Brind had his trade label engraved 'William Brind, from Mr. Reads', [that was Samuel Read,] between 1751 and 1776.

Widows also pointed out their trade antecedents, as Mercy Meymott said 'Late Read', referring not to her lately deceased second husband but to her long deceased first husband, Joseph Read.

It is difficult for us, bombarded by the media, to recognise the great importance of reputation, good will and recommendation by word-of-mouth. It was difficult, in the 18th century, to find out where to go for a product that, perhaps, one only replaced every ten or fifteen years. There were no directories categorised by trade, few newspaper advertisements and no catalogues pushed through the door. If a shop-keeper had his scales repaired by the year, he would probably go again to the same scalemaker, assuming that he was satisfied with the old scales. If he wanted a change, he might ask a neighbour, go into a scale shop nearby or wait until he went to one of the central markets in London and look at the scale shops there. There were clusters of scalemakers along Snowhill and Holborn and round the corner in West Smithfield. The roads round St. Martins Le Grand, St. Anne's Lane and Maiden Lane, (later remodelled as Gresham Street,) must have had a scalemakers' every four shops along. It must have been quite easy to find a scalemaker around the Royal Exchange, in Cheapside, Queen Street, Wood Street and Bartholomew Lane, that would be patronised by people with business at the Stock Exchange or the Bank of England. To want a scale when not using London shops regularly must have caused problems but probably certain makers got a good reputation and hence, ex-employees boasted of their training, and tried to benefit from their previous master's reputation.

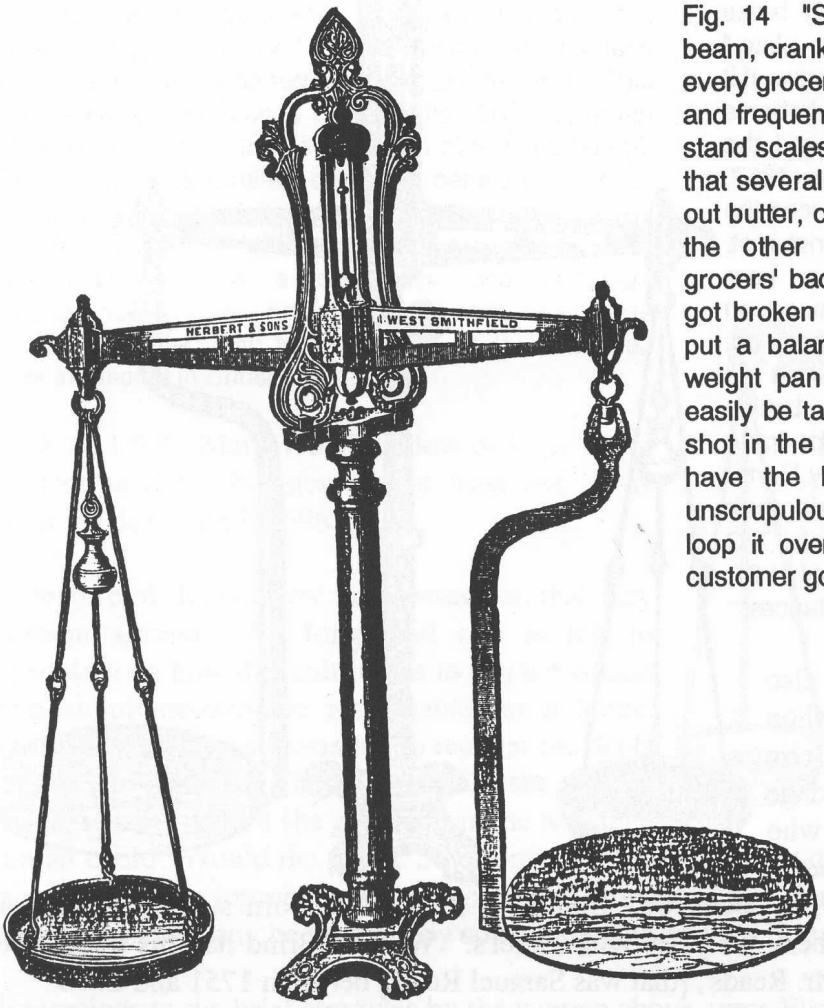


Fig. 14 "Stand Scale with best brass agate beam, crank and scale and china plate." Almost every grocers' shop must have had at least one, and frequently three or four, of these handsome stand scales spaced out along their counters, so that several assistants could use them to weigh out butter, cheese, bacon, sugar, raisins and all the other commodities that arrived at the grocers' back door in sacks. The china plates got broken so frequently that the scalemakers put a balance ball between the links on the weight pan side, so that a china plate could easily be tared by adjusting the amount of lead shot in the balance ball. It was made illegal to have the ball on a long link, because an unscrupulous grocer could pull the ball up and loop it over the beam. This meant that the customer got less goods than he paid for.

Business goodwill was utilised by makers taking over the shops of other makers. Herbert's took over the premises of the Woods at 6 & 7, West Smithfield, and presumably 'inherited' some of their customers. John Goodman was succeeded by England, Parker & Sommers at 27, Hosier Lane in 1805. We know of numerous examples in the 19th century and, by deduction, assume that it happened in the 18th century, even though we have few documents to prove it. Thomas Goulding took over from John Wood by 1764, and was succeeded by John's son, Richard, at the same address. We have no record of a formal arrangement, but one can imagine the Wood family getting together after the death of John and discussing with Thomas Goulding, who was four years older than Richard and had completed his training with John Wood, how to keep the business going and still give Thomas Goulding a fair chance to run the business in his own right. We do not know where young Richard Wood worked after he completed his training in 1768, and before he took over from Thomas Goulding in 1789. Richard Wood was gracious enough to put on his label 'Late Goulding', rather than 'Late John Wood', so we can deduce that Goulding had built up a good reputation in the twenty five years that he was in charge.

Similarly, William Fletcher took over from John Grout at 35, Fashion Street, one of five places where Fletcher worked. John Peck was succeeded by Webb and Skinner. Benjamin Hiatt and Mary Hiatt were succeeded by Samuel Phillips at 18, Vine Street by 1832, while Henry, James and Sarah Hiatt were succeeded by William Henry Miles at 80, Old Street Road by 1832. As the Hiatts were making Standards, we can assume that their work was of high quality, and that W H Miles thought that it was worth-while to take over at their premises. He repeated the exercise by moving to the premises of Frederick Steven London, at 74, Houndsditch, in 1833, (taking his new

customers with him?) and was succeeded himself by Booth and Simmons at his last address at 200, Shoreditch High Street in 1875.

Something needs to be said about the boys who became apprentices. A great number of the scalemakers' London apprentices had been pupils at the Christ's Hospital School, (colloquially known as the Blue Coat School because of the long blue coats and yellow stockings worn by the boys long after such coats were out of fashion,) amongst whom were Edward Lawrence and Thomas Goulding, both previously referred to, John Goodman, who left school in 1741, and Samuel Ogden, who left school in 1687. Many boys who had been to Christ's Hospital were apprenticed to scalemakers, but never became masters themselves, as with Thomas Abraham Gilas, bound to John Blackburn in 1791; Jonathan Delver Ballard, bound to James Dutton in 1815; Joseph Flude, bound to Thomas Gibson in 1772; R S Spratt bound to Nathaniel Jones in 1787; and four of Thomas Gable's apprentices between 1738 and 1760. The probable reason for so many apprentices' being schooled at Christ's Hospital was because the education given at the school was unusual at that date. An emphasis was put on numeracy, calculations and what we now call physics in the Mathematical Ward, opened in 1672. The boys were recruited disproportionately for the scientific instrument making trade, the scalemakers' trade and the Naval Officers' profession. The Blue Coat boys must have made other boys, educated mainly to translate Latin and Greek, with a massive knowledge of the Bible, seem incompetent by comparison.

Christ's Hospital also played a part in enabling young men to set up in business, and many scalemakers profited from that initial injection of money. Robert Hudson was paid £5 in 1812, and Charles Lawrence £5 in 1810, to enable them to set themselves up in business, which they would have been unable to do without that lump sum.

An earlier fund, available to scalemakers, was run by Blacksmiths' Company. Like many Companies, they had been left money specifically to help their young men, in Blacksmiths' case, by Mr. Powell. The arrangement was that the young man got a lump sum, which he was obliged to pay back within a short time. Richard Leyborne was lent £4 for two years in 1646, but he only managed to pay back part of the money in 1648. No record has been found to tell us what the Master and Assistants of Blacksmiths' did about the loss to their fund. Henry Dixon's charity, run by Blacksmiths', has already been mentioned on page 1740.

After perusing this chart, one wonders how Herbert's were able to compete with so many other scale companies, who had just as many well trained men working for them, with shops in equally advantageous positions and offering just as great a range of products, but succeed they did, and they are now one of a handful of real makers of shop scales (as opposed to retailers) in Britain today.

The records used to draw up this chart were, in the vast majority of cases, found by Michael and Diana Crawforth between 1970 and 1988, when Michael died. Clarification on some makers, and extensions of their dates, with the names of some hitherto unknown makers, were generously given to the Crawforths by Dr. John Chaldecott, who has been working for many years on a list of Scientific Instrument Makers recorded in London Trade Directories from the Directories' first appearance in about 1750, up to 1850, a convenient cut-off date, which coincided with the change from little workshops to big companies making scientific instruments.

This chart was sent to Jim Herbert for his comments. He made it clear that this chart is only the beginning of this research. So many companies were working from about 1880, about which I know nothing, so many mergers, separations, take-overs and associations took place that only a person intimately connected with the industry can explain. We must wait for the next instalment from Jim Herbert.

With thanks to Dr. Peta Buchanan for her assistance.

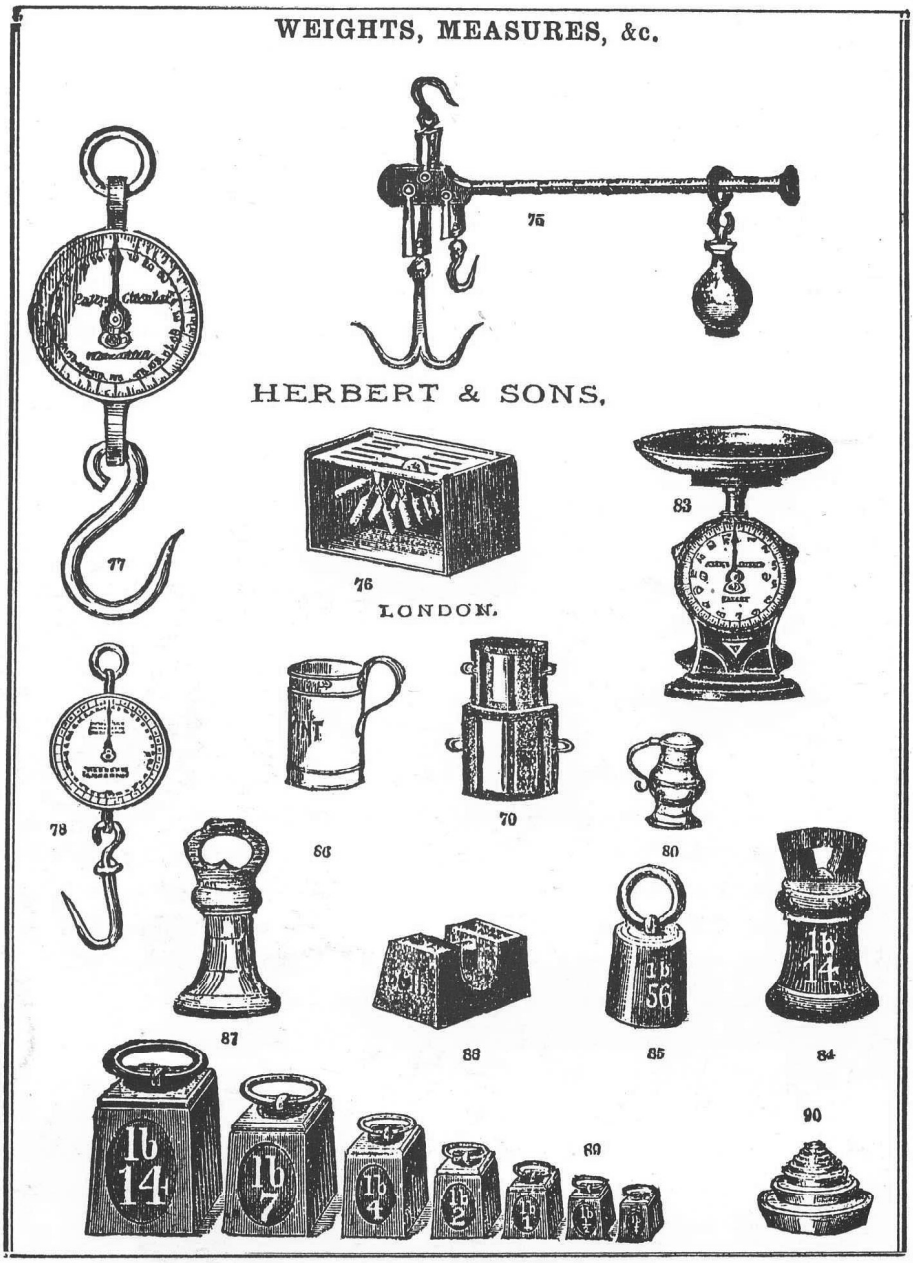


Fig. 15 A final page from Herbert's catalogue of about 1900. No. 76 showed G Davis' counterfeit coin detector, patented in 1853, to check the sixpence, fourpence, threepence, half-sovereign, sovereign, (twenty one shillings,) shilling, florin (two shillings,) half-crown and crown, (five shillings.) W & T Avery were still offering this detector in 1916. Used on counters. No. 83 showed Salter's top pan household spring balance. Note the early handle design on the bell weight, no. 84. The pint measure, no. 86, was the tin type used into the 1940s to measure out milk. No. 70 was a stack of two wooden measures for dry goods such as dried peas. No. 80 was a ½ pint mug of the kind used in public houses for beer.